ELECTRICAL REVIEW

THE PIONEER ELECTRICAL WEEKLY OF AMERICA

VOL. LI. No. 16. NEW YORK, SATURDAY, OCTOBER 19, 1907. ISSUED WEEKLY

CHARLES W. PRICE . . . . . PRESIDENT AND EDITOR
STEPHEN H. GODDARD . . . . . SECRETARY AND MANAGER
WM. HAND BROWNE, JR. . . . . TECHNICAL EDITOR
AINSLIE A. GRAY . . . . . MANAGING EDITOR

NEW YORK
PUBLISHING OFFICE . . . . . 13-21 PARK ROW
CHICAGO
WESTERN OFFICE . . . . . MANHATTAN BUILDING
BOSTON
NEW ENGLAND OFFICE . . . . . 95 MILK STREET
LONDON
EUROPEAN OFFICE, HENRY W. HALL, Manager, 42 OLD BROAD STREET, E. C.

TELEPHONE AND CABLE
TELEPHONE "21 Cortlandt." Private exchange to all Departments.
REGISTERED CABLE ADDRESS: "Electview," New York.

SUBSCRIPTIONS

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

ADVERTISING

CHANGES for advertisements should be in this office by *Friday noon* for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than *Monday noon* to assure publication in that week's issue.

Published weekly by the ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York. Charles W. Price, president and treasurer; Stephen H. Goddard, secretary.

Entered at the Post Office at New York as second-class matter under the Act of March 3, 1879.

CONTENTS

EDITORIAL:
Candle-Power Standards . . . 623
The Grounded Neutral . . . 624
Investigations of Atmospheric Electricity . . . 624
The Parent of Radium . . . 625
The Street Railway Conventions . . . 626
The Kansas Gas, Water, Electric Light and Street Railway Association . . . 628
Pumps and Pumping Machinery, by Joseph H. Hart . . . 629
New Quarters for the New York Electrical Trade School . . . 630
Some New Foreign Steam Turbine Plants . . . 631
Electric Interurban Lines in Ohio . . . 634
Experience with a Grounded Neutral on the High-Tension System of the Interborough Rapid Transit Company, by George I. Rhodes . . . 634
Electrical Supplies for the Navy Department . . . 635
The Grounded Neutral, with and without Series Resistance, in High-Tension Systems, by Paul M. Lincoln . . . 636
The Grounded Neutral, by F. G. Clark . . . 637
LETTERS TO THE EDITOR . . . 638
Victoria Falls Power . . . 638
American Society of Mechanical Engineers . . . 638
Electrical Dinner Given by Mr. Huntley . . . 629
Increase in Production and Exportation of Japanese Copper . . . 639
The Railway Signal Association . . . 640
The Supply of Hard Wood . . . 641
Caisson Sections for the Detroit River Tunnel . . . 641
The Open Sale of Bell Telephones . . . 642
The Measurement of Electrolytic Resistance . . . 642
The Kendall Gold-Mining Flywheel Motor-Generator Set . . . 643
"For California" . . . 644
Standard Symbols for Wiring Plans . . . 644
American Institute of Electrical Engineers . . . 645
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE . . . 648
INDUSTRIAL SECTION:
The Trumbull "Kappa" Switch . . . 650
General Electric Company Builds Factory in Twenty-nine Days . . . 650
Allis-Chalmers Type "OB" Pneumatic Governor . . . 651
The Manufacture of Christensen Air-Brakes . . . 652
A New Electrolier . . . 652
An Interesting Exhibit at the New York Electrical Show . . . 653
The International Independent Telephone Association . . . 653
Annual Report of the Western Union Telegraph Company . . . 653
CURRENT ELECTRICAL NEWS . . . 654
RECORD OF ELECTRICAL PATENTS . . . 659

Copyright, 1907, by Electrical Review Publishing Co.

CANDLE-POWER STANDARDS.

Just at this time when so much attention is being directed towards the standard of luminous intensity, it is interesting to point out certain differences in practice which seem to be well established in the gas and electric lighting industries. The latter, due to the peculiarities of its lamps, uses a standard as fixed as it is possible for human means to fix it, and even those lamps which might be subject to external influences are referred to this fixed standard, which is an incandescent lamp and, therefore, not affected by surrounding influences. On the other hand, the gas lighting companies advocate the use of a flame standard in their measurements because the candle-power of the gas flame is affected by the atmospheric conditions, and they argue that it is only fair that in meeting a prescribed condition the standard should be subjected to the same influences as the illuminant being tested.

At first thought there seems to be some justice in this contention, but after all is it fair to the consumer? What the latter really wants is light, and he merely purchases gas because that is the most convenient thing to measure. The gas companies, on the other hand, want to sell him a given quantity of gas, the quality of which is to be fixed by a varying standard, and the amount of light which the consumer gets depends then upon the condition of the weather. It perhaps is not unfair to compare this practice with the suggestion that a heating company while professing to heat buildings, need only agree to maintain a certain difference of temperature between the inside and outside of the building. In cold weather, then, the occupant of the room would have to suffer because his room would be correspondingly uncomfortable. The gas people say, in effect, "If you want a certain illumination, you must use so much gas, but if the weather conditions are not just what they should be, you will not get as much light as you expect to get." Of course it is not put to the consumer in this way. In fact, he is seldom aware of the fact that the weather does affect his light. The gas companies may say that their practice is only fair since they can not control the weather, but in other business the same conditions arise and must be met. Public heating companies must be prepared to supply sufficient heat in cold weather, and other public services are not given special privileges when the weather is unfavorable. If it be practical it would seem to be only just to require that the gas companies should furnish not only gas of a certain minimum candle-power, but that the standard used in determining this should be a fixed and not a variable quantity.

THE GROUNDED NEUTRAL.

At the recent meeting of the American Institute of Electrical Engineers three papers were read, abstracts of which are given elsewhere in this issue, which dealt with the question of grounding the neutral on high-tension transmission systems. Three points of view were taken, and naturally there were three solutions of the problem.

This is one of those engineering problems involving a compromise, and naturally the compromise which is made depends, in each individual case, upon the special conditions obtaining. As was pointed out by Mr. P. M. Lincoln in his paper, which took up the subject from a general viewpoint and avoided special considerations, there are advantages in grounding the neutral point of a high-tension three-phase transmission, but doing so brings in certain disadvantages which may or may not, according to local conditions, be less objectionable than the conditions existing without a ground. He sums the situation up briefly in the following way: The advantages are the fixing of a limit to the difference of potential between any conductor and the ground. This prevents abnormal static induction on neighboring circuits and makes possible the detection and immediate removal of a ground on any portion of the system. It also provides opportunity for using the ground as a workable conductor. The disadvantages are the fact that with the grounded neutral a ground of any one of the conductors is apt to disable a part or the whole of the transmission system, and further it is often difficult to obtain a satisfactory ground. The latter disadvantage is not so important, since it is merely a matter of detail. The preceding one is, however, serious, for reliability of service is one of the most essential requisites of a power-supply system. The question then is generally, "Does the fact that a single ground on any one conductor at once establishes a short-circuit on the system offset the possible gain obtained through grounding?" And this question must be decided in each particular case as it arises. The relative weights of the two sides of the question are affected by the size of the system, by the character of the load carried, and by the type of the generating station.

If an engineer does decide to ground his neutral the next question is, "Should this ground be direct or through a resistance?" This is the particular phase of the question taken up by Mr. G. I. Rhodes in his paper and he gives the reasons for using a resistance which led the Interborough Rapid Transit Company, of New York city, to adopt this method. The idea in using the resistance is to limit the short-circuited current caused by a ground on any conductor. This resistance must be small enough to enable the protective devices to operate safely and surely and yet it must be large enough to prevent destruction to these devices and to the generators. The experience of the Interborough company is that grounding a neutral through a suitable resistance has decided advantages, for, although it has not decreased the number of cable burnouts, it considerably reduces the effect of these accidents upon the station and hence increases the reliability of the system.

The other point of view is taken by Mr. F. G. Clark in his paper, for while this advocates the grounded neutral, Mr. Clark thinks that in the certain particular case which he describes, results would have been better had the resistance been omitted from the ground connection. This is a local question for each system and must be solved in such a way as to secure the greatest protection for the system. In the particular case described by Mr. Rhodes he thinks the inductance of the system itself would limit the current to a safe value, so that the resistance in the ground circuit simply tends to prevent the prompt operation of the safety appliances.

The effects of the grounded neutral are not limited simply to the transmission system, but may be carried back into the station, particularly if there are no step-up transformers, the generators themselves producing the high potential used in transmission. This is the case with the Interborough company's system, and it has been found here that the neutral of but one generator should be connected to the neutral bus at a time, as otherwise slightly unbalanced conditions, due either to the generators themselves or to the driving engines, will give rise to cross-currents which overload these machines.

The discussion of these papers did not bring out any new points, but those who took part related their experiences and gave good evidence on both sides of the question. In all such discussions, it is well to remember that the requirements of good practice differ in different parts of the country, and what is allowable in one place or on one system, would not be tolerated in another or for another kind of service. Although every company seeks to maintain a reliable supply, reliability is defined differently in different places. The question whether to ground or not to ground, must be decided by the engineers, who should balance the ills of the practice against the good effects.

INVESTIGATIONS OF ATMOSPHERIC ELECTRICITY.

Some time ago we suggested that an excellent field for the exercise of ingenuity and skill lies in the investigation of the electrical property of the atmosphere. There is to-day an increasing number of painstaking and courageous experimentists who are making a study of aeronautics, and it was suggested that these enthusiasts might make good use of their opportunities if they would take up, in connection with their ascensions, investigations of the atmospheric conditions. The general opinion of engineers seems to be that the only flying machine really worth while is a device without a gas bag. Perhaps it would be better to say that this is the only one which it is thought can be brought to a stage which can be depended upon under all conditions, while the dirigible balloon can only be controlled under favorable weather conditions. But the balloon will, no doubt, prove useful for many purposes. At the present time it seems to be the only one available for certain researches in the air, particularly those which must be made some distance above the ground. A good deal of this work of studying the air could be carried on in a balloon not fitted with a paddle, and it is this type which is now so popular for what are called

"balloon races." Now, such races as have taken place during the last few years seem to be a poor sort of sport, for although they involve a certain amount of danger, and hence excitement, the outcome depends largely on luck. True, a slight help toward making the longest flight can be gained by a knowledge of the atmospheric air currents, but we are unfortunately very ignorant as yet of these matters as well as of the electrical conditions. It seems for these reasons that much more useful knowledge could be obtained if these efforts were directed toward solving the many atmospheric problems which are now waiting for solution than by seeing which gas bag can stay up the longest time or be blown by the wind the greatest distance.

These ideas are strengthened by an interesting paper published in the current issue of *Terrestrial Magnetism and Atmospheric Electricity,* this being contributed by Mr. Y. Homma. The author, in this study, points out the reasons for not accepting earlier suggestions due to Erman, Kelvin, and others regarding the distribution of electricity in the atmosphere, since these are not in accordance with observed conditions. He, therefore, makes the assumption that the charge of electricity complementary to the earth's charge can not be considered as fixed at an infinite distance or even at a definite distance above the earth, but it may be assumed to be distributed throughout the atmosphere. Under this assumption several possibilities arise. Either the distribution of the electricity may be uniform throughout the atmosphere; or it may be densest near the surface of the earth and decrease in the upper layers; or the reverse condition may be true, the quantity of electricity being less near the surface of the ground and greater as the distance from the surface increases. The rate of variation in either case may follow several laws. These assumptions are submitted to a mathematical analysis and the laws which the potential gradient should follow in each case are deduced. These results are then compared with such experimental data as are available, but unfortunately these are too indefinite to enable the author to decide upon which of the several conditions is most likely to obtain.

Here then is a definite problem awaiting solution, and to solve it it will be necessary to secure a large number of carefully taken observations so that the disturbing effects of wind and other influences may be eliminated. Although a balloon can explore only a relatively thin layer of the air, it to-day offers practically one of the best means of this study, since the height attainable by kites is, of course, much less.

There is another reason for studying the atmosphere, and this is to assist in advancing the art of wireless communication. As is well known, communication by means of electrical waves is generally much better at night than during the day. During the daytime the distance which can be covered by a certain system is fixed, the conditions seeming to be fairly constant.

The reason for this is supposed to be the layer of ionized air in the upper atmosphere caused by the ultra-violet rays of the sun.

It seems likely that this is the true explanation, but we have as yet no direct evidence. It is believed by some, who have made a special study of these problems, that this layer of ionized air which is present during the daytime is somewhere in the neighborhood of fifty miles above the surface of the ground. If this be true, there are at the present time no means for proving it except experimentally in the laboratory. Nevertheless, all additional information regarding the electrical and other properties of the atmosphere is important in the art of wireless communication.

THE PARENT OF RADIUM.

Shortly after the discovery of radium, one of the most interesting lines of research which was taken up was that of tracing the products formed by its apparent disintegration. These have been traced through many forms, and many remarkable facts have been discovered. It seems evident that radium itself is not a primal form of matter, but is descended from some other element higher, that is to say, heavier, than itself. Ultimately, it seems to come from uranium, though there are intermediate stages or generations, and it becomes of interest to determine which of these immediately precedes—in other words, is the parent of radium.

Some time since we noted the suggestions of Mr. B. B. Boltwood that actinium was the parent of radium. He was led to this conclusion by eliminating the other and intermediate materials; but a further study of the subject, aided by prolonged investigation, has led Mr. Boltwood to the conclusion that actinium itself is not the parent, but is the grandparent, and that the true parent had not hitherto been isolated. By careful chemical separation, he has secured a preparation which produces radium, but which does not contain actinium. Moreover, the rate of production of radium in solutions of this parent is not appreciably affected by the presence of actinium and its products.

In studying this new substance, important relations have been observed between the growth of radium with a substance other than thorium in the solution. Another significant fact is that this radioactive constituent does not appear to possess any of the characteristics of recognized radioactive elements. Another proof that this substance is a new element is furnished by the properties of its alpha radiation. These rays emitted by it are more readily absorbed by screens than the corresponding rays from polonium. Although the element has not yet been isolated, the evidence pointing towards its existence is strong, and it seems without doubt to be a disintegration product of uranium, and is in all probability the immediate parent of radium. Dr. Boltwood suggests a name, "ionium," for the new substance, deriving this name from the word ion. He says that the name is appropriate because of the ionizing action which it possesses.

The Street Railway Conventions.

The American Street and Interurban Railway Association and the Affiliated and Allied Organizations of the Engineers, the Accountants and the Claim Agents Hold Forth at Atlantic City, N. J., October 14-18.

THE American Street and Interurban Railway Association and its affiliated and allied organizations, the Engineering, the Claim Agents' and the Accountants' associations, held their annual conventions at Atlantic City, N. J., from October 14 to 18, inclusive. Quite a large number of delegates had arrived on Sunday, October 13, so that the registration was well under way by noon on Monday, October 14.

Monday morning was devoted principally to the registration of delegates and guests, and the real business of the meetings began on Monday afternoon.

The fifth annual meeting of the American Street and Interurban Railway Engineering Association was called to order in the sun parlor on the steel pier at 2.40 P. M., when President H. H. Adams introduced John I. Beggs, president of the American association, who addressed the meeting quite briefly.

Mr. Beggs referred to the present organization of the parent and the affiliated associations, and said that the time had arrived when it was more important than ever before for representatives of the properties to stand shoulder to shoulder. The progress which had been made by the Committee on Standards was very satisfactory. This work means more than simply a better facilitating of shop practice of track work. It means that the executives in charge of the railway properties will find a way to meet the commercial needs more satisfactorily.

Following Mr. Beggs, President Adams called upon C. L. S. Tingley, president of the Accountants' association, who thanked the engineers for their cooperation in formulating and working out various plans for the betterment of accounting and for making the statistics more valuable.

E. W. Olds, past-president of the Engineering association, then addressed the meeting, dwelling particularly upon some impressions of the earlier days and the changes which had taken place since that time.

President Adams then delivered his annual address, saying in part:

Your executive committee has prepared a programme for this meeting that covers a very broad field. This has been brought about by the assigning of committees to various subjects, in addition to the papers to be presented by the gentlemen who have so kindly consented to honor us.

The report, as submitted by the Standardization Committee, represents the most important one that has been presented in the history of the association, and, although the work of the committee has been somewhat slow, it represents not only the views of the operating men, but those of the manufacturer as well. It is exceedingly desirable that definite action be taken on the report at this meeting, in order that a start may be made in the direction in which we have been looking for a long time.

The report of the Committee on Maintenance and Inspection of Electric Equipments covers a vast subject in a very able manner and the data presented is exceedingly valuable; the report shows the necessity of further investigation along these lines and several standing committees should be appointed to deal with the same for the future.

The report of the executive committee was presented, and the treasurer's report, which was then read, showed receipts for the year of $1,412.66. The expenses were $1,376.08, leaving a balance of $36.58.

In place of the report of the Committee on Control Apparatus, a valuable paper was presented by F. E. Case, of the General Electric Company, entitled "Recent Improvements in Control Apparatus for Railway Equipment." This paper described the K-34 controller, suitable for use with either two 150-horsepower or four seventy-five-horse-power motors rated at 500 volts; the K-35 controller, for use with either two 100-horsepower or four fifty-horse-power motors and less; the K-36 controller, for use with two motors of a capacity of sixty horsepower each and less. The improvements in type M control were also described, as were the new features of the circuit-breaker and fuse boxes.

It was announced that Mr. Cooper, of the Westinghouse Electric and Manufacturing Company, who had been invited to present data, had been detained by an accident and would not be present. In his stead N. W. Storer described briefly the Westinghouse company's electropneumatic type of unit control.

Following Mr. Storer's remarks, L. L. Smith presented the report of the Committee on Maintenance and Inspection of Electrical Equipment.

After a brief discussion the session was adjourned.

On Tuesday morning President Adams called the session to order at 10 o'clock. The first business was the report of the Committee on Way Matters. F. G. Simmons, chairman of this committee, announced that the report was embodied in various subcommittee reports. The Way Committee was assigned the task of preparing two papers for presentation before the convention, one on the care of urban and interurban roadbed and track, which had been prepared by George L. Wilson, engineer of the Twin City Rapid Transit Company, Minneapolis, Minn. The other paper would have to be omitted at this meeting.

President Adams then called for the paper by Mr. Wilson, which was entitled "Care of Electric Railway Tracks."

This paper was discussed by E. O. Ackerman, engineer of maintenance of way of the Columbus Railway and Light Company, Columbus, Ohio; C. H. Clark, F. G. Simmons, President Adams and A. M. Schreiber.

A. L. Whipple, chairman of the Entertainment Committee, announced the reception to the presidents of the affiliated societies for Tuesday evening, and also extended a cordial invitation to every one to attend the theatre party at the Savoy Theatre and at Young's Pier Theatre on Wednesday evening.

The discussion of Mr. Wilson's paper was then continued by W. Boardman Reed, E. N. T. Ryder, Mr. Ackerman, M. J. French, W. J. W. Griffin and Mr. Schreiber, and was concluded by a reply to inquiries by Mr. Wilson.

The report of the Subcommittee on Rail Corrugation Investigation was presented by Mr. Simmons, chairman of the committee. This report was discussed by Mr. Wilson, C. Voynow, Mr. Reed, Mr. Simmons, Mr. Olds and I. E. Matthews.

The next matter under consideration was the report of the Way Committee on

concrete tie investigation. The committee reported that there was not enough definite information secured to enable a report of any value to be presented.

The report of the Subcommittee on Rail and Rail Matters was then presented.

Upon the conclusion of this report President Adams announced the following committee on nominations: C. H. Clark, Buffalo, chairman; George L. Wilson, Minneapolis; Charles Hewitt, Philadelphia; George A. Smith, Kansas City; W. D. Wright, Providence, R. I.

The session was then adjourned.

The engineers held further meetings on Tuesday afternoon and on Wednesday morning and afternoon.

Officers were elected for the year as follows:

President—F. G. Simmons, superintendent of construction and maintenance of way, Milwaukee Railway and Light Company, Milwaukee, Wis.

First vice-president—Paul Winsor, chief engineer of motive power and rolling stock, Boston Elevated Railway Company, Boston, Mass.

Second vice-president—F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Company, Philadelphia, Pa.

Third vice-president—W. H. Evans, master mechanic, International Railway Company, Buffalo, N. Y.

Secretary and treasurer—J. W. Corning, electrical engineer, Boston Elevated Railway Company, Boston, Mass.

Executive Committee—The officers and W. J. Harvie, electrical engineer, Utica & Mohawk Valley Railway Company, Utica, N. Y.; William Roberts, superintendent of motive power, Northern Ohio Traction and Light Company, Akron, Ohio; E. O. Ackerman, engineer maintenance of way, Columbus Railway and Light Company, Columbus, Ohio; J. J. Murphy, electrical engineer, Chicago Union Traction Company, Chicago, Ill.

The opening session of the American Street and Interurban Railway Association was held on Wednesday morning, when the Hon. F. P. Stoy, mayor of Atlantic City, welcomed the railway men. This meeting was held jointly with the affiliated and allied associations. The American association held sessions on Wednesday afternoon and on Thursday morning and afternoon, winding up its meeting on Friday, October 18.

The Claim Agents held meetings at the St. Charles Hotel on Monday, Tuesday and Wednesday.

The Accountants held their meetings at the Chalfonte Hotel on Tuesday, Wednesday and Thursday.

The annual meeting of the Manufacturers' association was held at 11 A. M. in the casino hall, on Thursday, October 17.

The appliance exhibit of the American Street and Interurban Railway Manufacturers' Association presented a remarkable aggregation of electrical appliances for street railway and allied industries. The entire space on the steel pier was utilized, the registration booths of the American association and the Manufacturers' association flanking, respectively, the right and left entrances to the pier. To the left, in the main entrance, were the fine reception rooms of the *Electric Railway Review*, the ELECTRICAL REVIEW, the *Electric Traction Weekly*, the *Railroad Gazette* and the *Street Railway Journal*. On the right was the elaborate exhibit of the Sherwin-Williams Company, with the Buckeye Engine Company, the Recording Fare Register Company and the National Railroad Trolley Guard Company just around the corner.

Entering the main walk of the steel pier, there was seen the splendid exhibit of the General Electric Company. This comprised a large exhibit space in the foreground, complemented by a handsome reception room, where the General Electric represenatives entertained their hosts of visitors. A feature of the General Electric exhibit was a booster set supplying current to a GE-202 commutating-pole, direct-current, series-wound motor, which, in turn, drove a GE-90 motor as a generator, connected with a water box for varying the load. With the booster it was possible to get a voltage range anywhere from 300 to 900 volts, and the exhibit was made to demonstrate the sparkless commutating features of the motor on extreme variations of voltage and overload. The various details of the assembly of a 1,000-kilowatt vertical Curtis turbine were also shown, and the exhibit included smaller geared type commutating-pole railway motors, a portable motor-driven air-compressor, G. E. rail bonds and terminals, hydraulic and pneumatic bonding and rail-driving machines, and a G. E. straight-line air-brake equipment with emergency valves and unit control.

Flanking either side of the entrance to the uncovered portion of the steel pier, and to the right and left, respectively, of the General Electric exhibit, was an extensive display of the products of the Pennsylvania Steel Company and William Wharton, Jr., & Company. In this section of the pier there were the very interesting displays of the Joseph Dixon Crucible Company, the Chicago Pneumatic Tool Company, the H. W. Johns-Manville Company, the Lorain Steel Company, Wendell & MacDuffie, the American Sewer Pipe Company, the Franklin Electric Manufacturing Company and the Holophane Company. The two last-mentioned companies made a joint exhibit showing the "Novi" railway lamp made by the Franklin Electric Manufacturing Company in a vibratory device, demonstrating the ability of the "Novi" lamp to withstand the excessive vibration experienced in railway operation. Another very interesting and valuable demonstration was made by the Holophane Company, showing the actual increase in illuminating intensity of the special "Novi" Holophane reflector. Both for reading purposes and for showing up the color values of the seat coverings, the display was a remarkable tribute to the effectiveness of this form of reflector.

In the next section of the pier were the elaborate exhibits of the Ohio Brass Company, the Crouse-Hinds Company, the Blake Signal and Manufacturing Company, the Consolidated Car Heating Company, the National Brake and Electric Company, the Electric Storage Battery Company, the Southern Exchange Company and the Allis-Chalmers Company.

The Allis-Chalmers Company's exhibit was a great attraction for the railway men, and the company's straight-line air-brake equipment with the new type "OB" governor and emergency valve was set up and operated under perfect conditions, provoking a great many very favorable comments.

The most elaborate exhibit on the pier was that of the Westinghouse companies, where every conceivable apparatus or device for electric railway operation could be found. This exhibit included the entire hemispherical end of the second section of the steel pier.

In the narrow portion of the pier, which leads from the second section to the aquarium, were located the exhibits of the National Carbon Company, the Speer Carbon Company, Dossert & Company, the Rail Joint Company, the Sterling Varnish Company, the Pittsburg Insulating Company, Emil Calman & Company, Dearborn Drug and Chemical Works, United States Electrical Signal Company, and the Hale & Kilburn Manufacturing Company.

One-half of the aquarium and a considerable portion flanking each end sec-

tion were occupied by the Electric Service Supplies Company. The company's exhibit was most interesting and attractive.

The opposite half of the aquarium was occupied by the Galena Signal Oil Company, flanked by the Gold Car Heating and Lighting Company.

Further along the pier were the interesting exhibits of the Elmer P. Morris Company, the Samson Cordage Works, Holmes & Allen, the Crocker-Wheeler Company, the Danville Car Company, the Western Electric Company, the Ball & Wood Company, the D & W Fuse Company and the Massachusetts Chemical Company.

Beyond the sun parlor were the exhibits of Albert & J. M. Anderson, the Locke Insulator Manufacturing Company, the Goldschmidt Thermit Company, United States Graphite Company, the Gould Storage Battery Company, the Union Electric Company, the Lord Electric Company, the Sterling-Meaker Company, and the Yale & Towne Manufacturing Company. The latter company showed for the first time a new solenoid-controlled hoist equipped with a 650-volt, direct-current, series-wound crane motor. This hoist has been designed particularly for service in car barns and repair shops, for lifting car bodies and for taking the motors from out of the truck frames. In addition to this apparatus there was also shown a foundry control electric hoist, a twenty-ton triplex chain block, an overhead trolley system, and a model of a jib crane equipped with the company's triplex block for car-barn and shop work.

One of the pleasing features of the Manufacturers' exhibit was the prodigality with regard to the distribution of souvenirs, many of which were not only very handsome, but of great practicability. Among those distributed on the opening day of the convention were the following: ladies' hat pin, United States Metal and Manufacturing Company; ash tray and pocketbooks, Galena Signal Oil Company; medallion, Allis-Chalmers Company; lead pencils and playing cards, United States Graphite Company; slipper cricket, Peter Smith Heater Company; bouquets, Buckeye Engine Company; paper weights, Southern Exchange Company; medals, Western Tube Company; thimble, dice box and pencils, Joseph Dixon Crucible Company; paper cutter and cane, Shelby Tube Company; rubber mat, Massachusetts Chemical Company; foot rule, Elmer P. Morris Company; cigarettes, Franklin Electric Manufacturing Company; matches, National Carbon Company; matches, Crouse-Hinds Company.

Among those registered on the opening day of the convention were the following: R. P. Tell, National Brake and Electric Company; A. H. Englund, Electric Service Supplies Company; C. B. Coates, Chicago Pneumatic Tool Company; Max A. Berg, Electric Service Supplies Company; N. W. Storer, Westinghouse Electric and Manufacturing Company; J. C. McQuiston, Westinghouse Companies' Publishing Department; F. H. Gale and J. R. Lovejoy, General Electric Company; E. G. Chamberlain, Southern Exchange Company; G. W. Spear, Dearborn Drug and Chemical Works; C. H. Weeks, Buckeye Engine Company; R. H. Harper and F. D. Killion, Western Electric Company; J. W. Perry, H. W. Johns-Manville Company; S. I. Wailes, National Brake and Electric Company; W. S. Heger, F. C. Randall, W. G. Clayton, Allis-Chalmers Company; Elmer P. Morris, H. S Tanks, P. H. Holmer, Elmer P. Morris Company; J. N. Richards and F. F. Vandewater, Standard Paint Company; L. O. Duclos, Arthur E. Duclos and A. T. Baldwin, Massachusetts Chemical Company; W. S. Sisson, L. W. Downes, G. W. Steere and Robert Adams, D & W Fuse Company; J. W. Duntley, W. O. Duntley and Thomas Aldcorn, Chicago Pneumatic Tool Company; D. W. Page, New Departure Manufacturing Company; A. S. McCombe, American Sewer Pipe Company; H. M. Lauritzen, Holophane Company; P. S. Klees, G. O. Curtis, C. N. Thorpe and C. Leonard, Franklin Electric Manufacturing Company; R. G. Whiting, Samson Cordage Works; C. H. Spotts, Joseph Dixon Crucible Company; E. A. Dossert, J. J. Dossert, Dossert & Company; C. S. Hawley, Consolidated Car Heating Company; A. S. Watts, Locke Insulator Manufacturing Company; J. S. Speer, Speer Carbon Company; William Hazelton, C. W. Beaver, Yale & Towne Manufacturing Company; E. J. Burke, C. S. Blake, Blake Signal and Manufacturing Company; J. S. Crider, O. T. Weaver, National Carbon Company; A. F. Hills, H. B. Crouse, F. M. Hawkins, Crouse-Hinds Company; H. J. Wrape, American Carbon and Battery Company; R. C. Eccleston, Ridgway Dynamo and Engine Company; Harold P. Brown, John C. Dolph, Standard Varnish Works; E. M. Hamlin, F. W. Lord, G. B. Crane, Lord Electric Company; Charles Blizard, R. C. Hull, Electric Storage Battery Company; Richard C. Smith, Safety Insulated Wire and Cable Company; George Loring, National Electric Lamp Association.

Kansas Gas, Water, Electric Light and Street Railway Association.

The Kansas Gas, Water, Electric Light and Street Railway Association met in Topeka, Kan., October 9, with E. S. Springer, president of the association, in the chair. The president in his address reviewed the improvements and changes made during the past year and spoke of the work done by the association.

The first paper was by E. L. Callahan, of the General Electric Company, on the "Commercial Importance of Heating Devices to the Central Station." Mr. Callahan gave a practical paper on the introduction of heating devices and how they could be used to make money for the plant.

W. E. Sweezey, superintendent of the Junction City Electric Railway, Light and Ice Company, gave an offhand talk, which was very practical, on the management of a small plant, and spoke especially of how the management should treat the public and its customers.

A paper on the programme that showed careful preparation and was one of the best received was by J. S. Skinner, superintendent of the Lawrence Electric Light Company, on "Increased Sales to Present Consumers."

"The Underground Water Supply for Municipalities of Kansas" was a tabulated statement of the recent investigation made under recent act of the legislature, and showed what good work had already been done.

Professor B. F. Eyer, of the State Agricultural College, read a paper by F. W. Willcox, of the General Electric Company, on "Economies of High-Efficiency Lamps." This subject greatly interested every member present. What will be the effect on the business, and how best to make the most of what the future has in store for the tungsten, tantalum and Gem, is the query.

A paper on "The Benefits of the Association" was to have been given by F. W. Mackey, but he was detained. His paper will be published in the proceedings.

"Electric Law" was treated by John C. Nicholson, president of the Electric Light Company, of Newton. This took up, first, the relation of the company to the public; second, the relation of the company to third persons, and, third, the relation of the company to its employés, with special emphasis on the law of damages.

"Natural Gas *vs.* Electricity was the topic discussed by John T. Huntington, superintendent of the Topeka Edison Company. Mr. Huntington showed how the electric companies could and should succeed where they have natural gas as a competitor.

"Municipal *vs.* Private Ownership of Public Utilities" was the subject of a well-digested paper by Jesse Shaw, superintendent of the city waterworks of Topeka, who was formerly superintendent of the same plant when under private ownership.

The discussions were animated and interesting, and in nearly every case confined strictly to practical suggestions on points brought out by the papers read.

The following officers were elected for the ensuing year:

President, S. L. Brown, of Abilene; first vice-president, A. L. Newman, of Arkansas City; second vice-president, W. A. Scouthorn, of Hutchinson; third vice-president, W. R. Murrow, of Independence; secretary and treasurer, James D. Nicholson, of Newton; executive committee, W. S. Grosvenor, of Kingman; J. N. Wells, of Pittsburg, and Willis Watson, of Dodge City.

PUMPS AND PUMPING MACHINERY.

BY JOSEPH H. HART.

Much has been written on the subject of pumps and pumping machinery, but this has been confined almost exclusively to the subject of relative efficiencies, design, constructive details, and a number of other points which are not of much importance to a man making a decision on the type of pump installation for a particular purpose. Thus he will readily obtain efficiencies of the different types, and their various methods of operation, but the question of what to install for a particular purpose, when reliability, maintenance, and first cost are the important features, is practically unanswered. Thus, there are in existence to-day, ordinary surface pumps, of double and single action, deep-well pumps of the vertical type, several systems of pumping machines known technically as airlifts, the centrifugal pumps of single and multiple-stage, and the high-speed type known as the turbine pump. The choice of a type from this collection for a particular purpose and the method of installation of one or more of these pumps in series or parallel for a particular purpose has not been treated with the completeness that the importance of the problem warrants.

Pumps and pumping stations are becoming more and more numerous everywhere and their purposes more varied. The average manufacturer is beginning to realize that it is cheaper to install his own water supply, than to purchase it, in the great majority of cases, even when the consumption of water is comparatively moderate. This is a foregone conclusion, that all power plants even of moderate size, require their own pumping equipment, supplying not only the plants in large cities where water is attainable from the city supply, but also where water is obtainable by any other method. Electrolytic copper refining works employ large power plants where the load is constant and the demand for water fully as great as in many railway and lighting systems. Refrigerating plants also often have large power plants to operate, to produce their refrigeration. In fact, the list could be stretched out indefinitely, and in general, it can be said, whenever power is produced even on a moderate scale, pumping machinery must be installed, not only for a boiler supply, but for fire protection and also for the steam condenser, when the plant is of such a size as to warrant a condensing engine. In refrigeration, water is used not only for all these purposes, but also for the ammonia condenser, and for the absorber as well, if the refrigeration machine is of the absorption type. Sufficient has been said, however, to show that the demand for water is great in nearly all lines of manufacture and the result has been shown conclusively that it almost invariably pays for a consumer to install his own water supply.

Under these circumstances he comes at once to the choice of a pumping system and method of installation. He wants first, reliability; second, small cost of maintenance; and third, small first cost. These are the important features and are in the order named, in regard to their relative significance. In the great majority of cases the question as to whether one pump is absolutely more efficient than another is of minor significance. The problem involves a broader outlook and requires an immediate answer, and this depends almost invariably upon the source of water supply. If this is obtained from lakes or rivers, ordinary surface pumps, or a good centrifugal type, or any one of the various devices is satisfactory and the choice depends upon other factors. If the water is obtained from deep wells the choice is limited somewhat by the mechanism of the pumps, but reliability and maintenance are in reality the important factors. In many cases the seeker for such installation is without available water supply and must obtain this. Often, lakes and rivers are cut off by rights of way, especially in the large cities and thus become unavailable. Wells are the only alternative and there is as much variation in the type and character of wells as there is in that of pumping machinery.

If the supply of water must be obtained from wells almost invariably more than one well must be drilled.

The quantity of water required in many modern operations is such that the average well is unable, even if of large capacity, to supply the necessary output. Thus the question becomes one primarily of character and number of wells, followed by character and number of pumps, with the methods of connecting these for the purpose required. In drilling a well the question of water is problematic. Chances are always taken that no water will be obtained and the nature of water flowing underground is such that two wells ten feet apart may be at opposite extremes in regard to output. Thus, it is reasonable at the beginning to take minimum chances, and make a number of shallow wells, increasing the depth of one or more of these as seems best. Thus, in reality, exploration must actually occur, whether recognized or not, and good business principles warrant a small output of money at this stage. Thus, the man should sink several shallow wells, determining their capacity, and either increasing the number or depth as desired, until the required output is obtained. The ordinary dictum of well diggers that in any case it seldom pays to go below 1,500 feet is absolutely true in the majority of cases and this figure should be cut down considerably, since not only is water more unlikely to be obtained at these depths, but the character of the water itself is often such as to render it unfit for boiler consumption and condenser work and many other applications.

Now, given a number of surface wells or surface and moderately deep wells, the question of installation of pumping machinery in this development becomes one of great importance. If the wells are entirely surface wells, ordinary surface pumps can be installed. These pumps are of the ordinary horizontal piston variety and are able in practice to lift water from a depth of about twenty-six feet. The great majority of wells depend, in regard to their output, upon the recession in the well, however. This is the depth to which the surface of the water in the well will fall below normal when the water is being delivered. If the recession is very great, the well drains a larger surrounding territory, and also drains it more rapidly, thus increasing enormously the output of the well. Thus an ordinary surface well may have a certain definite output when the recession is carried to the bottom, but if sunk twice as deep and the recession then carried to the bottom the output may be four times as great. Ordinary surface pumps are limited to a depth of twenty-six feet on the suction side by the working principle back of them. If the recession falls below this point the vacuum is broken and the pump ceases to operate until suction is reestablished. The height to which water can be forced on the other side is dependent only on the steam pressure obtainable, and the strength of the pump to withstand pressure. Such pumps have the advantage, however, that a single one can be connected to any number of wells and water drawn from all at the same time. The possibility of breaking the vacuum, however, is increased in such an installation in direct proportion to the number of wells connected. Again, such a pump is a large steam eater. There is no cut-off in the steam cylinder on account of the fact that the pressure must

be maintained through the entire stroke and the steam exhausts into the atmosphere or condenser at boiler pressure, thus causing a large waste. Of course, in mining operations, ordinary surface pumps can be installed at the base of the shaft or at places where the suction is always less than twenty-six feet, and in these cases this fails to be a disadvantage and the question becomes one of relative efficiency merely, and first cost in the choice of types. However, in surface wells, if the recession is carried below twenty-six feet, ordinary surface pumps become unavailable and another type must be selected.

The deep-well pump and steam head is an adaptation of the ordinary surface pump to meet deep-well requirements. The pump is placed at the bottom of the well with the shaft vertical and the steam head, consisting of steam cylinder and piston, at the top in a line directly over pump. The shaft on this may be made of any length and the disadvantage of a limitation due to the twenty-six feet suction is eliminated. The shaft, in the great majority of cases, consists of a wire rope for especially deep wells and the action is only in one direction, the piston returning by the force of gravity to its starting point. The advantage of a deep-well pump over ordinary surface pumps is simply that by increasing the recession enormously one pump may be made to do the work of several by making one well deliver the output. Deep-well heads, however, have all the disadvantages from an efficiency point of view that ordinary surface pumps have. They are large consumers of steam, but are very reliable, as their action is thoroughly understood and simple in the extreme. Their first cost is also small in comparison with other types, when single pumps are installed.

However, a deep-well head or deep-well pump, rather, can not operate more than one well. If the output from this well is insufficient to meet the demands additional pumps must be installed for each additional well utilized. This applies in general to all wells where the surface of the water is carried more than twenty-six feet below the surface of the ground, where ordinary surface pumps become unavailable unless sunk beneath the surface. Under these circumstances the installation must consist of often a large number of deep-well heads, or of other pumps. Centrifugal pumps are much more efficient than ordinary surface pumps. They are limited, however, by the twenty-six feet suction effect and can not operate below this level. Deep-well centrifugal pumps, operated by electricity at the bottom of wells, have been installed and have proven satisfactory, but at a large first cost and considerable cost of maintenance. The only other type available is what is known as the air-lift system, and this exists in several different developments. The air-lift system consists primarily of a compressor for the production of compressed air and a reservoir for its storage. With these accessories or a source of compressed air available, the pump proper is simplicity itself, both in constructive details and maintenance. If a pipe is inserted into a well below the water line and compressed air driven through it, the air in rising carries the water with it. The bubbles act as little pistons and in expanding and rising give the water an upward momentum sufficient to carry it to considerable heights. The operation of these wells depend simply upon the quantity of air available and its pressure, and is independent of the sources of supply. Thus, a single air-reservoir will operate any number of wells from almost any depth. With reduction valves to vary the pressure, water from different depths in different wells can be readily lifted to a common reservoir, from which it can be drawn as needed. A number of other types of the air-lift system consist of modifications of this method, together with an adaptation of the ordinary piston pump. Thus the air is often made to drive a piston, with the consequent lift of water, before it escapes and further aids the lift. The disadvantages of the air-lift system are many, and its advantages are equally as numerous. The pump proper is of minimum first cost, its range of adaptability to a number of wells of different output and varied depth is remarkable, and it is practically as efficient as any other type in ordinary installations. The action of the pump proper in lifting water is fairly efficient. The production of compressed air, however, in the compressor is very inefficient. However, a compressor compares more than favorably with the operation of an ordinary steam cylinder in a surface pump. There exists a steam cut-off in a compressor so that the expansive force of steam is utilized, and hence less steam is used. On the other hand, the compressor itself, owing to tight packing and friction losses and the adiabatic compression of the air, is about in the same class for efficiency as the ordinary surface pump. Its range of adaptability, however, is much greater. Its first cost also is much greater than a single pump, but when several pumps for deep-well heads must be installed, the compressor compares more than favorably in regard to the first cost of installation. A disadvantage exists in the fact, however, that the water is thoroughly mixed with air on emergence and must subside for a period to become free of this before use in many applications. Thus in condenser work, air should be rigidly cut out of the cooling coils, if the condenser is of the type used in refrigeration work. If a barometric condenser is used, or one in which the water comes directly in contact with the steam, the presence of air only increases the work of maintaining the vacuum.

In regard to reliability, an air-compressor is not an absolutely reliable mechanism. In many cases of air-lift water supply, the entire plant has been compelled to be shut down on account of a necessary stoppage of the compressor. If the air-lift system is installed, at least two compressors should be operated. In cases where as much as eight or ten wells are operated, this is not a serious question, even from a first-cost point of view. In regard to reliability, the greater number of units installed the more reliable is the plant. One or more units can be shut down with continued operation of the entire plant on diminished water supply, but complete shut-down is not necessary. If a single pump is installed, undoubtedly the centrifugal pump is the most reliable. There are no valves to get out of order, the load is uniformly constant, and an efficient engine may be used to operate this, or it may be operated by electricity, or by a turbine with very efficient results. If the character of the water supply is such, however, that this is unavailable, deep-well heads should be installed if the number of units are few. If this number increases to any extent, the air-lift system should invariably be installed. Of course, this is a dictum applying in a general way to all pump installations. Individual equipments may have conditions such that entirely different conclusions may be drawn, but this is the general status of the problem as it exists to-day in the majority of pumping installations.

New Quarters for the New York Electrical Trades School.

The New York Electrical Trades School has recently opened a new building equipped with every facility for practical instruction at No. 39 West Seventeenth street, New York city. The school is now making a feature of giving free public lectures on electricity. These began on Tuesday evening, October 15.

Some New Foreign Steam Turbine Plants.

SWITZERLAND is one of the countries in which the use of steam turbines, both in large and small units, is receiving the greatest development. Economy of coal is a most important item in this region, and the economy which is claimed for the steam turbine has led to its adoption in a number of the new plants, or where new groups are to be added to already-existing plants. This is true not only of the large-size turbo-generator sets, but also for groups of a moderate size. Such groups find a ready application in large factories and establishments of different kinds where an economical current-generating set for supplying motors for use throughout the shops or for lighting is required. In the following article an account is given of the new electric plant at Neuchatel, which is commencing to use steam turbine groups, a description of the turbine outfit which is in use in one of the large factories, and an account of an interesting use of turbines in a brewing establishment at Rotterdam.

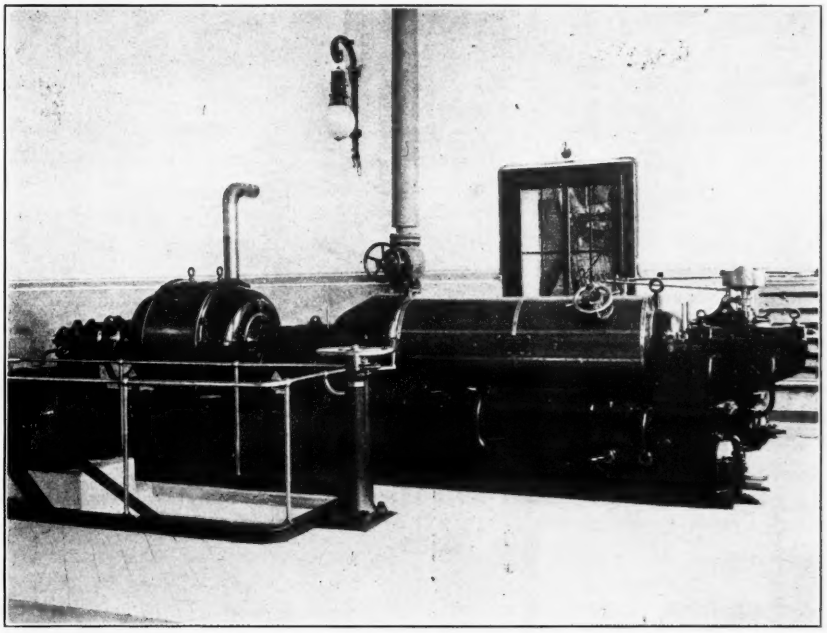


FIG. 1.—450-HORSE-POWER TURBINE, CENTRAL POWER PLANT, LAKE NEUCHATEL.

The new electric station of the city of Neuchatel was erected in order to meet with the increasing demands for current, and it was decided to build the plant within the city limits and equip it with steam turbine units. The plant thus affords an addition to the amount of power which the city obtains from the distant hydraulic plant at Pré-aux-Clées on the river Areuse. As the latter plant was running almost up to the full extent of its capacity, it became necessary to look for another source of power, and this led to the erection of the city plant. Here are installed both the new steam turbine outfit and the rotary converter substation equipment for the hydraulic plant. As coal is very expensive in Switzerland, the most economical method of operating was looked for. It seems that gas engines have not given the results which were expected of them; in the plants at Chaux-de-Fonds and at Bale, the low-carbon gas motors which were installed did not meet with much favor. Accordingly, steam turbines were decided upon, both on account of their economy and the small space they occupied, seeing that the station had to be built as small as possible, owing to the high price of ground in the centre of the city.

The Neuchatel station was laid out for six boilers of 250 square yards heating surface each, four steam turbine units of 300 kilowatts, and three rotary converter groups of 300 kilowatts, besides three smaller groups of seventy kilowatts. The boiler plant contains two boilers at present of the water-tube type and built by the Guilleaume Werke, of Neustadt. A superheater of seventy square yards surface is also used. The furnace grates have a surface of six square yards, and the production of steam is thirty pounds per square yard of surface, with an evaporation of ten pounds of water per pound of of coal. The superheating can reach as high as fifty degrees centigrade.

The steam turbine group which is mounted in the Neuchatel station is shown in Fig. 1. This group has a capacity of 300 kilowatts, with a steam pressure of eleven atmospheres at the inlet. It is of the condensing type, the condenser with its pumps being located in the basement underneath the group. When working at the full load of 300 kilowatts, the turbine operates at a speed of 3,000 revolutions per minute, or at 3,050 when running at no load. This speed can be varied some ten per cent on either side of the normal by regulating the spring on the governor.

This turbine was built by the Swiss firm, Brown, Boveri & Company, at Baden, and it follows the general lines of the Parsons reaction wheel such as this firm have been constructing for some time past.

Special attention is given in these turbines as regards the lubrication, seeing the high speed at which they are run. Oil under pressure of one or two atmospheres comes from below into a circular groove placed between the bearings and the shaft, and the result is that the entire bearing is full of oil, and the different parts of the bearing allow a uniform friction on the shaft. The oil pump, which is operated by a countershaft worked from the turbine, draws the oil from a reservoir in the foundation plate of the turbine, and a water circulation is provided in order to keep the oil cooled. At the Neuchatel plant this water is supplied by an injector working upon the city water mains, while the water for the cooling is taken from the lake. In cases where water is scarce, the water can be turned into the feed-water tanks. By this arrangement the temperature of the oil is kept down to about forty degrees centigrade.

The dynamo which is mounted upon the turbine shaft is a direct-current machine, and was also constructed by the Brown-Boveri firm. It is almost entirely enclosed, and is bolted down to the main foundation plate, being pro-

vided with a separate bearing on the outer end. This machine is designed to run at a constant speed of 3,000 revolutions per minute, and accordingly its size has been much reduced for its capacity of 300 kilowatts at this high speed. The reduction in size of such a dynamo which is built for the high speed of the modern steam turbines makes it difficult to secure a good self-regulation of the voltage, seeing that it is desired to obtain less than eight per cent drop in voltage from no load to full load. Such a small drop is more easily obtained in the large units, but in the present case the designers have been able after considerable work to secure a small drop even in these machines. It has been found best to adopt a system of compounding the fields, but this differs from the method which is usually employed in compound-wound machines in that the fields which are formed by the series and the shunt windings are not superposed, but placed at right angles to each other. The object of this arrangement is to obtain a resultant field from the armature and field-windings which shall have a fixed position in space and therefore does not shift its place under varying loads on the machine. Consequently the commutation axis is not displaced and there is but a small amount of sparking at the brushes. With this method, using a long form of commutator whose segments are held at the middle and at the ends by steel braces against the action of centrifugal force and employing copper brushes, the machine is found to give a very regular running without sparking or undue heating, or without requiring any shifting of the brushes for variations of load. When running alone, such a system has all the needed advantages, and the only drawback comes when parallel running with other machines is desired. In this event it is necessary to have the switchboard disposed as is usual for compound working, using compensating bars, balancing resistances, etc.

The makers gave a guarantee of 24.8 pounds of steam (using eleven atmospheres pressure at the inlet) per kilowatt-hour at full load, and 27.2 pounds at half-load, with the condenser water not to exceed twenty degrees centigrade. Comparing this with the performance of some of the recently built steam turbines of the same make and of about the same capacity, it may be remarked that the turbine installed at the Coise station, of 200 kilowatts, gave 21.1 pounds of steam per kilowatt-hour, but in this case the pressure was 12.5 atmospheres, and the superheating was carried on to a higher extent, or at 250 degrees. In the Tschöpeln station, the turbine of 400 kilowatts, working at seven and one-half atmospheres, used 23.1 pounds of steam per kilowatt-hour on the tests, which came considerably under the guarantee of 26.4 pounds. Again, in the Indret plant a 300-kilowatt turbine working on fourteen atmospheres, gave 23.3 pounds per kilowatt-hour, but here the work of condensation was not counted.

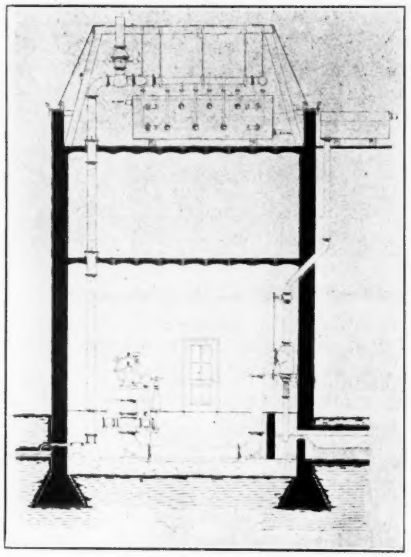


FIG. 3.—ELEVATION SHOWING WATER-HEATING PLANT.

These differences come from the varying conditions under which the turbines are operated. In building them it may be desired to have a special economy at full load, but in this case a corresponding increase of consumption at small loads will be found.

Under the normal running conditions, the tests which were made at the Baden factory upon the present turbine showed that the steam consumption for normal working is 23.1 pounds per kilowatt, while the tests carried on at the Neuchatel station gave about the same figure.

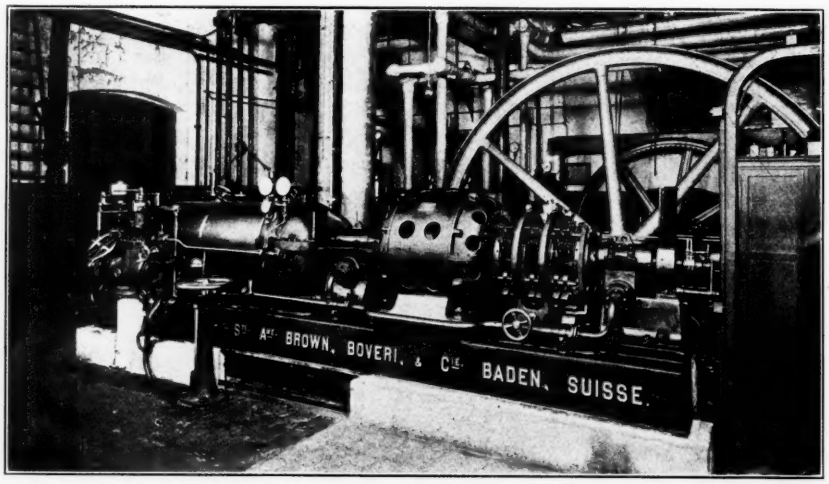


FIG. 2.—200-HORSE-POWER TURBINE IN BREWERY, ROTTERDAM.

The present plant has been erected under the general supervision of chief engineer R. Chavannes, one of the leading Swiss engineers, to whom we are indebted for the preceding details.

The turbine-dynamo group which has been installed in the large brewing and ice-making establishment of Oranjeboom, at Rotterdam, presents a special interest from the conditions under which it is operated, and shows the advantages which may be gained by using the exhaust steam from the turbines in factories and plants of different kinds.

In the present case the use of a steam turbine was preferred for the following reasons. A 700-horse-power steam engine had been in operation here, and it was used for the brewery and also to operate an ice-machine, also working a transmission shafting and a 130-kilowatt, direct-current dynamo. The latter generator supplied current for different motor-operated devices in the factory as well as for the lighting. Owing to the fact that the engine was obliged to run on a light load at certain times, it was decided to put in a smaller group consisting of an engine and a 130-kilowatt dynamo, with direct coupling. A steam turbine set of the Brown-Boveri type was chosen for the purpose. This turbine allowed the use of exhaust steam in a very economical way, which is one of the interesting points about the present plant, and shows what

an advantage is obtained from the turbine groups under certain conditions.

The water which was needed in this large establishment for rinsing and scouring the barrels, as well as for other uses, was contained in a reservoir placed in the upper story of the building. Before using, this water was heated up to ninety degrees centigrade by means of steam which was taken direct from the boilers. It was found that this method, which was very expensive owing to the great consumption of steam, could be modified by the use of the turbine, which allowed of bringing the exhaust steam directly into the water of the reservoir. This can be done, owing to the fact that the exhaust steam from the turbine contains no traces of oil. The water which is used for rinsing the barrels must be quite pure and free from oil, and to use the exhaust steam from an ordinary engine a system similar to a set of surface condensers to prevent contact between the steam and the water is used. But such a device must be of large size so as to utilize all the heat of the steam. Again, given the usual consumption of water, at an initial temperature of fifteen degrees, it is heated only to forty-five degrees, and from this point to the required heat of ninety degrees steam must be injected into the water directly from the boilers. Such a plant, with an ordinary engine would be costly to set up and would have a low efficiency. With a turbine dynamo, on the contrary, the exhaust steam can be mixed directly with the water by means of special injecting nozzles which plunge into the cold water and allow the latter to absorb all the heat of the steam.

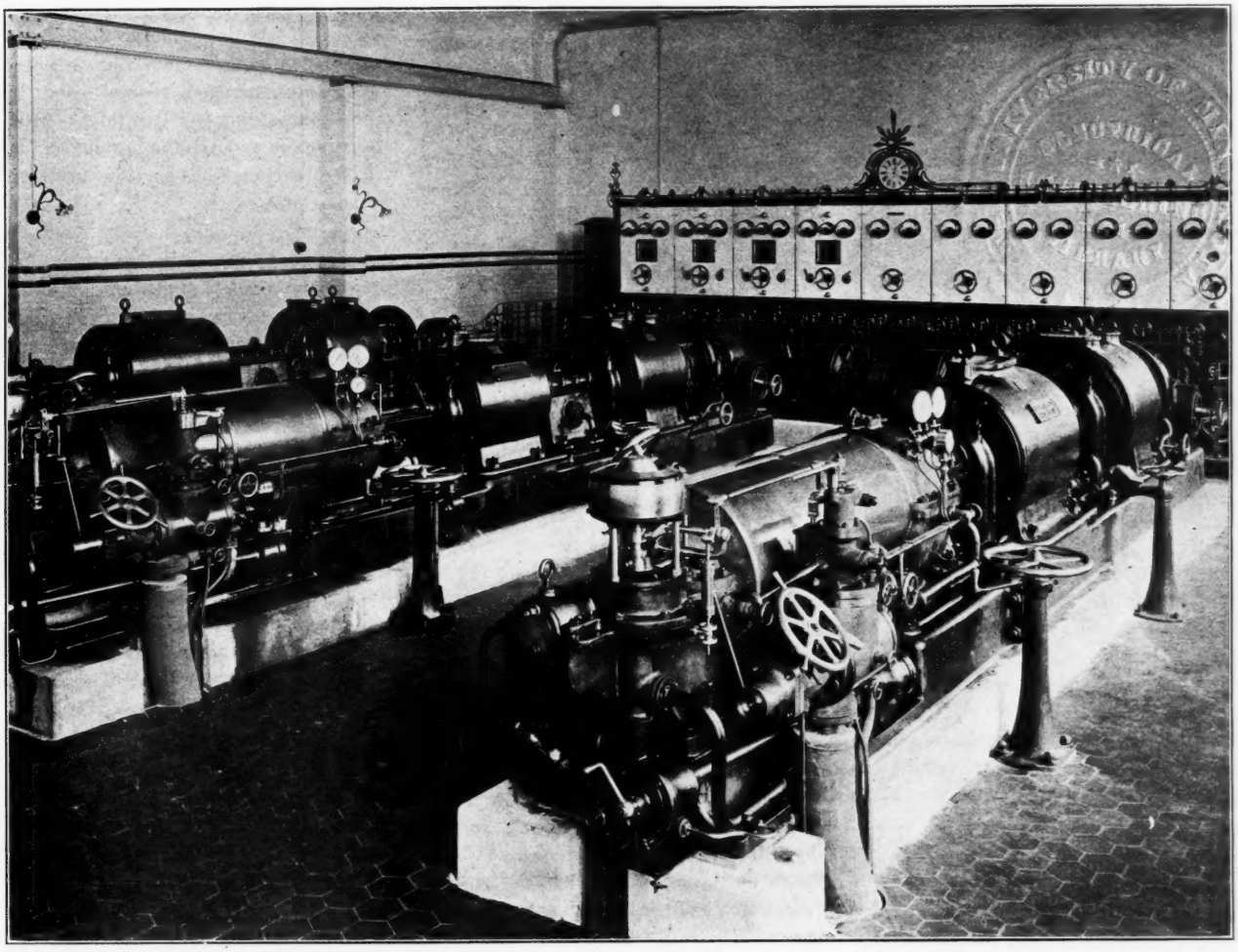


FIG. 4.—THE TURBINE PLANT AT ARBON.

The appearance of the steam turbine group, which is of the most recent design, is shown in Fig. 2. It works under a steam pressure of 130 pounds, using superheated steam at 250 degrees centigrade and operating at a speed of 3,000 revolutions per minute. The dynamo, which is designed by the same company, works at 115 to 120 volts. This group has a total length of about twenty feet and a width of four feet. The foundation plate of the group rests upon four masses of beton. Four bearings are used, two for the turbine and two for the dynamo. An elastic coupling is placed on the shaft so as to connect the two machines. The exciter is mounted on the outer end of the dynamo shaft. Mounted on the turbine is the main operating hand-wheel, working the inlet valve and allowing steam to enter the distributing chamber on the right of the hand-wheel. To the left is the governor of the turbine, which acts upon the steam inlet by a system of levers. The steam thus passes through the turbine from left to right and escapes by the exhaust pipe, passing thence to the water-heating apparatus.

The direct-current generator is of the specially designed type for use with steam turbines, and operates on the same system as the Neuchatel machine mentioned above. In these machines the outer field is of ring-form and has no projecting poles; the armature windings are held in grooves by means of strips.

The hand-wheel mounted on a column

in front of the turbine serves to operate a two-way valve by means of a rod and gear transmission. This valve is mounted upon the exhaust pipe of the turbine, just below the latter. By the use of the valve the steam is allowed to pass up to the top story for the water heating, or into a hydro-ejector of the Körting type, which is placed in the engine room (Fig. 3). As the consumption of steam is much smaller by the use of the condenser (hydro-ejector) than when the turbine works on counter-pressure, which occurs when the water-heating is in use, the turbine is run on condensation during the hours when the water is not required to be heated. The steam which passes to the top-story reaches a set of horizontal pipes running across the water reservoir, and a set of vertical tubes plunge into the water. On the ends are special nozzles which cause the steam to set up a water circulation, so as to give a uniform heating. As the best condition of working depends upon the relation of the steam output to the counter-pressure of the water, the large or small amount of steam which is left over from running the dynamo at variable loads is used to the best advantage by varying the height of the tubes in the water. They are therefore disposed in two ranges at different heights. For a small steam supply, the upper set is used alone, and when the amount increases, the lower set also comes into action. A number of tubes may also be thrown in or out of action by an automatic device according to the steam supply. In this way the plant is able to work automatically for all the loads on the turbine.

Fig. 4 shows a view of a turbine plant of considerable size which has been installed in one of the Swiss factories, the large weaving establishment of P. Heine & Company, located at Arbon. Electric motors of different sizes are used to a large extent throughout the factory for operating the weaving machines. To produce the current which is needed for the motors, as well as for the lighting of the premises, a plant laid out on the most modern principles has been erected in one part of the building. This is one of the largest and most complete steam turbine plants for private use which is to be found in the country. The three steam turbines which are represented here are all of the same type, and are built along the line of the groups just described. The capacity of these groups is 280 horse-power. They differ, however, from the former turbine sets in that each turbine is coupled direct to two dynamos. One of the latter is a direct-current generator, while the second is a three-phase alternator. The total output of the plant is therefore 840 horse-power. In this view the details of the governor and the main operating hand-wheel may be clearly seen. A marble panel switchboard for operating the direct and alternating-current circuits is placed at the end of the machine hall.

Electric Interurban Lines in Ohio.

The electric interurban lines of Ohio have, in obedience to the requirements of the railroad commission act, rendered their first annual report to the railroad commission. Included in these are only interurban lines with some few city lines whose business is so intermingled with the interurban business that a separation has been impossible. Strictly city lines have made no report. There are fifty-seven operating electric companies included in the statement, the statistics of which are as follows:

Main line mileage, 2,406.12 miles; total mileage, 2,646.14 miles.

Capital stock, common, $98,362,678; preferred, $15,964,225; total capital stock $114,326,903; entire funded debt, $32,920,000.

Interest on funded debt, $3,668,033.51; cost of construction and equipment, $171,465,925.84; average cost per mile, $52,542.14.

Gross earnings for Ohio, $12,256,659.85; operating expenses for Ohio, $7,403,396.05; income from operations, $4,863,334.52; miscellaneous income, $112,150.65; total income, $4,973,933.

Payments from total income, including interest on fixed charges, $4,342,748.08; net income, $1,092,221.42; dividends, etc., $433,584; surplus from operations, $710,148.72.

Total passenger revenue for Ohio, $10,533,963.76; total passenger earnings for Ohio, $10,920,912.48; total freight revenue for Ohio, $620,980.76.

Number persons employed, 6,952.

Salaries to employés and officers, $3,984,558.42.

Accidents for the year in Ohio: Passengers killed, 16; injured, 723; travelers on highways killed, 27; injured, 188; employés killed, 13; injured, 188; trespassers killed, 27; injured, 47; total killed, 83; injured, 1,146.

The list of killed and injured includes those in cities where electric lines do both city and interurban business.

EXPERIENCE WITH A GROUNDED NEUTRAL ON THE HIGH-TENSION SYSTEM OF THE INTERBOROUGH RAPID TRANSIT COMPANY.[1]

BY GEORGE I. RHODES.

The chief circumstance which led to the grounding of the neutral of the Interborough Rapid Transit Company's high-tension system was the serious nature of cable burn-outs. As a rule the detectors gave indication of a ground on one leg of the system from five to thirty minutes before the circuit-breaker opened, but on account of the large number of feeders connected it was practically impossible to isolate the damaged feeder before the short-circuit occurred. In a total of twelve operating burn-outs, the grounded cable was located but twice in time to prevent trouble.

In view of the fact that one phase of a cable almost invariably grounded some time before short-circuiting, it was decided to ground the neutral through a resistance of proper magnitude to allow sufficient current to flow to remove the grounded feeder without affecting the system in any other way. It is obvious that with only two feeders to a substation, a ground on one of them will open the circuit-breakers of both, and that the certainty of continuous operation of the substation increases with the number of feeders.

The scheme of grounding the neutral as originally proposed was as follows: The neutral point of each generator was connected to a common or neutral bus-bar through a disconnecting switch and a current transformer. The transformer operated a relay on the main switch of the generator. The neutral bus-bar was grounded through a resistance of about six ohms in each power station, making about three ohms' resistance between the neutral and ground of the combined system. In case of a ground, the maximum possible current was 1,000 amperes per rheostat, all of which was generated by the grounded generator. The relays on the feeder-switches were set to operate instantaneously at 300 amperes, and the generator relays at about 900 amperes after five seconds. Under these conditions it was to be expected that a ground on a cable would instantly remove it from service before any other disturbance could result.

The neutral rheostats were of the iron grid type having a resistance of about six

[1] Abstract of a paper read before the American Institute of Electrical Engineers, October 11.

ohms and a reactance at twenty-five cycles of about 0.3 ohm. They were made up in sixteen series sections, each insulated from the others and from the ground by porcelain insulators. Each section was made up of six series groups of cast-iron grids connected two parallel and twelve series per group. Each grid was made up of ten bars 0.25 inch by 0.75 inch by six inches, and two bars 0.25 inch by 0.75 inch by four inches. Extra grids were used to adjust the resistance to the required value. The rheostat will carry 1,000 amperes for two minutes, a capacity far in excess of anything that would be required in service.

With the scheme as above outlined, very serious trouble was encountered from the triple-frequency cross currents in the neutral connections. These neutral currents fluctuated very rapidly from nothing to one-half full-load current per generator. Upon synchronizing there was a very large rush of current in the neutral, so large in fact that with four generators running it was very difficult to synchronize a fifth with its neutral grounded.[1] These cross-currents had such serious effects on the operation of the system that the scheme of grounding the neutral was delayed for a time to allow making some experiments.

An oscillographic study of the neutral currents was made and has been described fully.[2] The records proved without a doubt that the currents were caused by irregularities in the angular velocity of the prime movers and unequal excitations of the generators. It was found that the insertion of resistance in the neutral connections of the generators would reduce the currents to a safe value. This, however, was undesirable on account of the variable resistance in the ground circuit, depending on the number of generators in operation. Furthermore, resistances of sufficient magnitude and capacity would have occupied too much space to be used in these power stations.

It was finally decided that full protection could be obtained by connecting but one line generator at a time to the neutral bus-bar in each power station. The transformers in the neutral connections were also disconnected from the relays on the main generator switch. Even with but one generator grounded in each power station, the interchange of current through the neutral rheostats, and the tie-line between the stations, is at times large enough to make it undesirable to open the neutral disconnecting switch of a live generator.

The Interborough Rapid Transit Company's system was operated for about three and one-half years without a grounded neutral, in which time about 160 miles of cable was operated for three years and 340 miles for one-half year. Since grounding the neutral, the system has been in operation for two years with about 340 miles of cable.

Previous to grounding the neutral, there were twelve distinct operating burn-outs, and since then there have been sixteen. It appears from this fact, that grounding the neutral has had no material effect on the number of burn-outs. This is as was expected.

Of the twelve burn-outs occurring previous to the grounding of the system, four shut down the power station; one other shut down two substations, and four more shut down one substation. Of the other three which did not shut down the substation, two were isolated in time to prevent a short-circuit. In all of these cases, there were five or six cables to a substation. During most of this period only the Seventy-fourth street power station was in operation, so that there were no tie-line troubles.

Of the sixteen burn-outs that have occurred since grounding the neutral, not one has caused a shut-down of either power station; eight have shut down the substation fed by the cable, two have caused one other feeder to open, and six have caused no disturbance other than the opening of the switches of the feeder in trouble. In three of the cases in which the substation was shut down, the tie-line between the power stations opened, but without disturbing the operation of either. Of the eight burn-outs which shut down the substation, three were stations having three feeders each, one having four feeders, two having five feeders, and two having six feeders. Of the other eight burn-outs which did not shut down the substation, two were substations having three feeders each, two having four feeders, two having five feeders, one having six feeders, and one having seven feeders.

Previous to the grounding of the neutral, the switches operated with explosive violence on the short-circuiting of a cable, at times throwing oil and burning the contacts. Under present operating conditions, however, the switches always open very quietly, so quietly in most cases that it was necessary to install a tell-tale to indicate when there had been abnormal current through the neutral rheostats.

Before grounding the system, in all burn-outs the cable was so badly injured that it was impossible to make any bridge test, and it was necessary to open a great many manholes before locating the trouble. Of the sixteen burn-outs that have occurred since the grounding of the neutral, fourteen of them were in such condition that the fault could be easily located by the Murray loop method. In most of these cases but one leg was grounded. In the two cases where all three legs were grounded, making the bridge test impossible, the burn-out was the result of very severe mechanical injury. Locations of the fault are always made within a duct length, even on the longest cables of more than 45,000 feet. The saving in time effected by this accurate predetermination of the trouble by the bridge method is an important factor in the time necessary to restore a substation to normal conditions of operation.

It is probable that something would be gained by increasing the resistance between the neutral and ground. When the scheme was first contemplated, it was planned to ground the neutral through six ohms, there being at that time but one power station. Now with two stations in parallel the effective grounding is through but three ohms, making the possible ground current twice that originally planned for. There is no doubt but that with the resistance as first decided upon there would have been fewer substation shut-downs.

From the above data, it is seen that grounding the neutral of this system through a series resistance has been quite successful. It has greatly reduced the disturbance from cable burn-outs and the time necessary to restore an injured cable to service.

[1] "Experience with a Grounded Neutral on a High-Tension Plant," C. W. Ricker, *Electric Journal*, September, 1906.

[2] "Neutral Currents of a Three-Phase Grounded System," *Electric Journal*, July, 1907.

Electrical Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., on October 29, for the following material: twenty-two distribution cabinets and panels, one motor-drive outfit, for delivery at Charleston, S. C.; miscellaneous electrical supplies, 40,000 glass-tube fuses, for Mare Island, Cal.; one motor-generator set for Norfolk, Va.

THE GROUNDED NEUTRAL, WITH AND WITHOUT SERIES RESISTANCE, IN HIGH-TENSION SYSTEMS.[1]

BY PAUL M. LINCOLN.

The object of this paper is to raise for discussion the question of grounding the neutral, a question that continually confronts the engineer operating an alternating-current generating, transmitting, or distributing system.

The questions that would arise in the mind of the operating engineer would probably be these:

1. Why should the neutral be grounded? What advantage would be gained, if any? and what disadvantages would be encountered?

2. If a ground is used, shall it be at one point of the system, or several?

3. Shall a resistance be used between the neutral and the ground? and if grounded at several points, shall a resistance be used in each place?

4. If a resistance is used, how much? and what shall be its current-carrying capacity?

5. What character of resistance is best?

Advantages—(*a*) Electromotive force between conductor and ground remains fixed and constant.

(*b*) Prevents abnormal static induction on neighboring circuits.

(*c*) Provides opportunity for using the ground as a working conductor.

(*d*) Makes possible the detection (and immediate removal if desired) of any grounded portion of the system.

(*e*) Insures equality in the condenser current drawn from each phase.

Disadvantages—(*f*) One ground disables a part or the whole of the system.

(*g*) A proper ground is difficult to obtain.

If an operating engineer has come to the conclusion that his neutral should be grounded, the next question is, naturally, that concerning the number of places to ground—whether it shall be at his power plant or plants only, or at other points where neutrals can be obtained. The answer to this question usually depends upon the object sought in grounding. If it is the use of the ground as a working conductor, there must naturally be grounds both at the generating and receiving points. On the other hand, if the object is to prevent an abnormal voltage rise on any conductor, due to the grounding of another, then the grounding of the neutral at one point is sufficient and in most cases preferable.

Probably the most important question in connection with this whole matter of grounding the neutral is that as to the use of resistance between the neutral and ground and the amount of resistance that is best. In any polyphase system, so long as each conductor has the same capacity, the same insulation from ground, and a balanced load, the neutral will remain at ground potential, whether it is connected to ground or not. In other words, so long as conditions on the transmitting or distributing system remain normal there is no occasion for grounding the neutral, as nothing will be accomplished thereby. The object sought in grounding the neutral is to take care, not of normal conditions, but abnormal ones. It is the first thought of the operating engineer to maintain his service, and he therefore installs automatic circuit-breakers and other devices to protect his system in case of an abnormal condition arising. The abnormal conditions that may arise are: 1, short-circuits; 2, open circuits, and 3, grounds.

1. By short-circuits is meant accidental connection in any manner between conductors of opposite polarity. It is evident that under this condition the behavior of automatic devices is in no way influenced by grounding the neutral, so that the consideration of this contingency is not pertinent to this paper.

2. In a three-phase line, with the neutral grounded at both generating and receiving stations, the ground will, under normal conditions, carry no current, even though the ground be of zero resistance. If, however, one of the conductors should break, the ground immediately begins to carry current. If induction or synchronous motors are being used at the receiving end, the three-phase relation will be approximately maintained, the degree of approximation depending upon the ground resistance and upon the relative motor load to non-motor load. If the neutral is grounded at one point only, an open circuit in one conductor will have an effect no different from that which would take place if the neutral were not grounded, except that the distribution of charging current between conductors will be somewhat disturbed and more or less of this current would pass through the ground connection.

3. A ground is the most frequent abnormal condition that is encountered, and also is the one most affected by grounding the neutral. With the neutral connected direct to ground, another ground on any conductor means a short-circuit; the action of automatic circuit-breakers will then take place accordingly. The amount of current that will flow through such a short-circuit can be limited by inserting resistance, and practically the only object of resistance is to cause such a limitation of current.

The flow of excessive currents, such as would take place were there no resistance, is detrimental for several reasons. It throws an unnecessarily great strain upon the circuit-breakers which are called upon to interrupt the current. The large current flow which takes place may cause a phase distortion and drop of voltage which may, in turn, be sufficient to cause synchronous apparatus on the line to drop out of step. Almost invariably an arc takes place at the point of grounding of conductors, and an excessive current will cause excessive destruction at this point. A dead short-circuit on any system causes a heavy shock due to the tremendous currents, and a consequent tendency to distort the windings of any synchronous apparatus connected to the system.

All of these objections can be overcome to a greater or less degree by resistance in the neutral. Increased neutral resistance, however, while it limits the current flow through a grounded conductor and overcomes the above objections, can do so only by allowing an increase in the potential of the two good conductors above ground while the current flows. If the object in grounding is to prevent such an abnormal rise, the inserting of resistance tends to defeat that purpose. The choice of the proper resistance becomes a question of compromise between the disadvantages of going to either extreme. There seem to be good reasons for adopting a ground resistance which will lie between the following limits: On the one hand, large enough to prevent a severe shock to the system; or the voltage on the affected phase dropping to a point where the synchronous apparatus will drop out of step. This consideration will dictate a resistance that will not allow more than, say, three times full-load current at the most to flow through the armatures of the generators supplying the circuits. On the other hand, the resistance must be small enough to permit sufficient current to flow to trip the heaviest circuit-breaker on the system.

If a ground resistance be used, the question of its current-carrying capacity is an important one. Since current is drawn through the ground resistance only

[1] Abstract of a paper read before the American Institute of Electrical Engineers, October 11.

during emergencies, its capacity should be chosen to meet the maximum that any emergency can throw upon it. Usually the time during which current will flow is limited to the time required to trip a circuit-breaker, probably not more than a few seconds at most. The quantity of current that will flow as a maximum is also fixed as that which is required to trip out the heaviest set circuit-breaker. The question of current-carrying capacity is therefore one which depends upon the character and setting of the safety devices used.

As to the character of resistance, permanency is the most essential. Considerable latitude is allowable in the amount of resistance, but that latitude does allow variations of many hundred per cent, such as past experience has shown is apt to take place with graphite mixtures or similar structures. A metallic resistance is satisfactory but has the objection of being expensive and bulky when the voltages involved are high. This problem has not yet been satisfactorily solved, but it seems probable that where high resistances are demanded—200 ohms or more—some form of non-metallic resistance will be found of sufficiently permanent character to be satisfactory.

THE GROUNDED NEUTRAL.[1]

BY F. G. CLARK.

During the consideration of the design of one high-tension installation, the question of grounding the neutral was investigated, and resulted in a decision to ground the neutral points of the generators through a limiting resistance. It was my privilege to contribute to that design and to recommend that this resistance be omitted.

The installation comprises a power station centrally located for the ultimate conditions prescribed, but unfavorable to the preliminary electrification of a steam railroad requiring seven substations, and underground and overhead transmission of three-phase current at 11,000 volts and twenty-five cycles.

The protective features are low-equivalent lightning arresters, inverse time-element relays or circuit-breakers, a peculiar method of operating exciters, and the grounded neutral. A voltage regulator has lately been installed and has a bearing on the situation.

The neutral point of each generator is led to a bus-bar through a fourth pole of the generator circuit-breaker. The neutral bus-bar is connected to one end of a cast grid resistance suitably insulated. The other end of the resistance is connected to a ground plate located in earth kept moist with salt water. There is 6.7 ohms' resistance, or sufficient to allow 1,000 amperes in the neutral circuit in the event of a ground. A current of 1,000 amperes will raise the temperature of the resistance approximately 1,000 degrees Fahrenheit in one minute. An ammeter on the switchboard indicates the amount of current in the neutral connection. A pilot lamp lights whenever fifty amperes or more flows through the resistance. This lamp remains lighted until an auxiliary circuit is opened, and has been instrumental in determining the number of short-circuits that were also grounds.

The grounded neutral affords protection against rises in potential and high-frequency oscillations due to grounds. Grounding the neutral has the disadvantage of increasing the number of short-circuits, and consequently the interruptions of service. There are conditions peculiar to each installation which have a bearing on this question, and these conditions determine the necessity of a resistance in the neutral circuit, the amount of resistance to be used, whether more than one generator should be grounded.

A consideration of these facts led to a decision to use a resistance of 6.7 ohms in the power station of the installation described. It was anticipated that this resistance would allow sufficient current to flow through any ground which might occur to clear the system of that ground, and that grounds on two legs or short-circuits would be cleared by the inverse time-element relays, or, if very close to the power station, by an interruption of service due to the "killing" of excitation. The events of operation indicate that the neutral ground is essential and that the other protective features perform their functions suitably.

Conditions obtain, however, which mitigate against the proper operation of this protective feature. One instance will serve to illustrate this point. A wire-rigged sloop which had been anchored near a cable-house drifted out of the channel until a stay-line connected with one leg of the transmission circuit, causing a ground. The ground held for about three minutes, when the boat shifted and another part of the rigging connected with a second leg, causing a short-circuit which opened the circuit-breaker. The current in the ground circuit was approximately 400 amperes, which was not sufficient to open any of the circuit-breakers between the ground and the power station. It was enough, however, to burn off an anchor chain and several of the wire stays on the boat, and to raise the temperature of the neutral resistance to that of a bright-red heat.

When the ground occurred, the neutral point rose from 0 to about 2,700 volts, and the two ungrounded legs were approximately 9,000 volts to ground. The electrostatic condition very nearly approached that which would obtain in an ungrounded system. The lightning arresters being set at 8,500 volts, began to discharge, and oscillations were a possibility.

The inductive drop and the resistance of the ground, added to the set resistance of 6.7 ohms, were sufficient to limit the current to 400 amperes. With the 6.7-ohm resistance out, the current would have been above 650 amperes, or sufficient to have opened the nearest controlling circuit-breaker in less than one second. The inductive drop was about 1,000 volts and the resistance through the ground sufficient to divert the current to the numerous telephone lines as paths of least resistance. The fact that telephone troubles are not coincident with grounds of short duration would seem to indicate that induction is not an important factor in this particular case. There have been no indications of trouble in telephone or telegraph lines due to induced potential.

Some action must be taken to prevent this ground current from causing trouble. The grounded neutral is a preventer of electrostatic troubles and therefore should be retained. The resistance is a positive detriment to receiving the full benefit of this effect. It should, therefore, be omitted whenever the local conditions will permit. In the case described this can be done without perceptibly increasing the hazard to apparatus. This would enable the relays to clear any of the grounds that have occurred within five seconds.

During two years' operation there have been over seventy short-circuits. About twenty-five of these have caused substation interruptions, and six have been close enough to cause power station interruptions. About one-half of these short-circuits showed a ground connection. There have been ten grounds, of which the neutral ground cleared eight. One held for four minutes and one for three minutes, both developing into two-wire short-circuits.

It is quite probable that in a system operating with underground cables only, there would be no outside disturbances in connection with sustained grounds. The lead sheaths which are generally bonded together in manholes would provide the path of least resistance for the ground circuit. The ultimate installation will require underground cables, and except for the greater power effects, and greater charging current, will alter the present situation but little.

[1] Abstract of a paper read before the American Institute of Electrical Engineers, October 11.

LETTERS TO THE EDITOR.

Photoelectric Property of Selenium.

To the Editor of the Electrical Review:

Permit me to call your attention to an error appearing in your interesting article entitled "A New Selenium Cell," which I have just read in the October 12 issue of your esteemed publication. Doubtless I am in the main responsible for said error, in not being more explicit in covering this point during our conversation over the telephone; at any rate it is most important that a correction be made. Near the end of the article on page 595 you say: "It is interesting to note in this connection Mr. Hammer's contention that there is no such thing as 'photoelectric action' of the selenium cell; that is, if one puts a cell in circuit with a galvanometer and allows a light to fall upon it, no deflection is obtained, as has been asserted; in other words, there is no electromotive force set up. The effect of the light is merely to change the resistance of the selenium layer so as to allow a larger current, supplied from some other source, to flow through the circuit."

The idea which I meant to convey was that when selenium cells were made with an enclosing chamber protecting them from the atmosphere, as in the case with the type of cell which I have devised, there would be no "photoelectric" action when said cell was placed in circuit with a galvanometer and a light allowed to fall upon the selenium. Of course, when a battery was included in the circuit the current from this battery would deflect the galvanometer needle in a varying degree, dependent upon the variation in the resistance of the selenium, which in turn would vary in accordance with the intensity of the light shining upon it.

On the other hand, if selenium cells are made (and they have in the past, as a rule, thus been made) with the selenium exposed to atmospheric conditions, the selenium takes up a certain amount of moisture, etc., and when such a cell is connected to a galvanometer without a battery in circuit the cell itself becomes a form of primary battery, and when a powerful light is allowed to fall upon the selenium cell, reducing its resistance sufficiently, a current passes through the galvanometer and the needle deflects to a greater or less degree, frequently causing rise to speculations as to the wonderful "photoelectric" properties of selenium.

In many early types of selenium cells, copper wires and plates were used and the cells were exposed to the atmosphere, thus causing selenides of copper to form, and measurements made day after day gave entirely different results; the cells were constantly deteriorating, and it has been my aim and object to obviate this deterioration, prevent photoelectric action, and secure reliability and constancy, as well as to take advantage of the well-known properties of quartz in permitting the very short wave-lengths to pass through the containing vessel, which would be entirely cut off by a glass envelope. I trust I have made my contention entirely clear and thank you for the opportunity of setting myself right before your readers.

William J. Hammer.

New York city, October 14, 1907.

"Papers and Conventions."

To the Editor of the Electrical Review:

The article in the Electrical Review under date of September 21, relating to "Papers and Conventions," was read with a good deal of interest. As a member of the National Electric Light Association and also of the American Gas Institute, I feel exactly the same as you do, as to the time given up to the reading of the different papers at our annual conventions. The whole time is often taken for the reading only of the papers and no time is left open for the discussion or for questions being asked, bearing upon these same papers. If one-half or one-third, as you state, of the number of papers, were read, this would give ample time for any and all queries and discussions for the different members to participate in, which I think would be of great benefit to a great majority of the members, especially so to the managers of the smaller stations.

R. E. Brown,
General Manager Mankato Gas and Electric Light Company.

Mankato, Minn., October 9.

An Aluminum Motor Wanted.

To the Editor of the Electrical Review:

We beg to inquire if you can furnish us with the name and address of a manufacturer of an aluminum motor intended for ærial navigation.

Henry W. Peabody & Company.
17 State street,
New York, October 8.

Victoria Falls Power.

A brief report of an interview with Ralph D. Mershon, who returned to England recently from a visit to South Africa in the interests of the Victoria Falls Power Company, is given in the *Electrical Engineer,* London. With regard to the project to transmit power from the Victoria Falls to the Rand, he stated that there was no doubt in his mind that such a transmission could be profitably effected. It was in 1897 that he carried out a series of experiments on high voltages, and three years ago undertook a series of further investigations along the same lines that enabled him to make the report he did to the Victoria Falls Power Company, Limited, as to the practicability of the project. On his present visit to South Africa he had personally inspected the Victoria Falls both above and below the gorge, and he was satisfied that an excellent electrical development could be made up to, if need be, 300,000 horse-power; and if means were taken, which could probably be done very economically, to conserve the water some little distance back from the falls, there would be a further large addition to the power that would be available. The immediate work before the company is the early provision of a further steam-driven electrical generating station on the Rand. At the moment the company with its two existing stations is quite unable to cope with the demand for power, and it has been compelled in advance of the erection of the new station to arrange for an extension of the existing station at Brakpan. With regard to the erection of the new 24,000 horse-power station, it is taking every possible means to expedite its completion and that was the work which was engaging his attention at the moment.

The American Society of Mechanical Engineers.

The American Society of Mechanical Engineers will hold its next regular monthly meeting on Tuesday evening, November 12, at 8.15 o'clock, in the Engineering Societies Building, 29 West Thirty-ninth street, New York.

The principal address will be made by Charles R. Pratt and will treat of features on construction and operation of the gearless traction electric elevator, which is being installed in the Singer and Metropolitan Life, New York's two highest buildings. The paper will be discussed by engineers and architects from New York, Philadelphia and Chicago. It is expected that the subject will be very exhaustively treated from the view of the architect and the engineer. The members of all professions are cordially invited to attend.

Electrical Dinner Given by Mr. Huntley.

Charles R. Huntley, president of the Buffalo General Electric Company and a former president of the National Electric Light Association, tendered a dinner to some of his former associates in the electrical business at Delmonico's, New York city, Saturday evening, October 12. The occasion was marked in a high degree by a friendly reunion spirit, old friends greeting their host and each other, in many instances the first time for half a score of years and more.

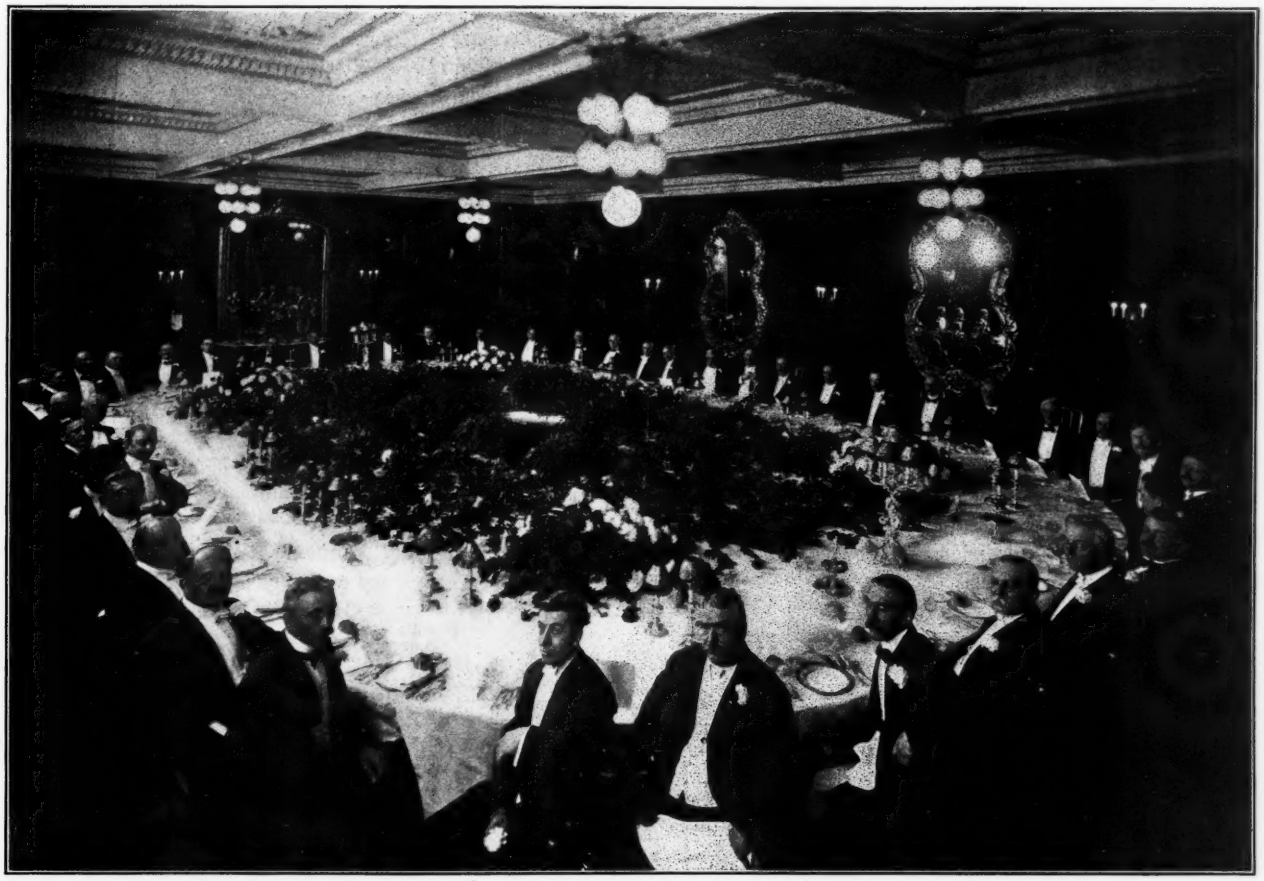
Mr. Huntley, whose birthday the occasion commemorated, looking fully ten years younger than the age he admitted, with his two sons, extended the most cordial of greetings to friends from Chicago, Boston, Pittsburg, Philadelphia and New York. Brief addresses of a reminiscent nature were made by a number of those present, among the speakers being Dr. Edward Weston, Nikola Tesla, Samuel Insull, William Stanley, John J. Carty, W. J. Clark, A. H. Patterson, C. L. Edgar, T. C. Martin and H. G. Stott. Dr. Weston was particularly interesting in speaking of historical pioneer work of the laboratory and shop, and of other phases of electrical science of early days.

No better dinner was ever served at Delmonico's. The table was a work of art, decorated and electrically lighted luxuriantly, with a fountain playing in the centre. Musicians were concealed behind ferns in a corner of the room. A flashlight photograph of the scene taken at the beginning of the festivities is presented on this page.

In addition to the host and speakers, there were present:

George Urban, George J. Jackson, Henry D. Stanley, A. J. DeCamp, Charles D. Shain, E. F. Peck, H. L. Shippy, Cyrus O. Baker, Dr. W. M. Habirshaw, Ambrose Butler, Arthur Williams, John A. Seely, Hugh Harrison, Robert Corey, E. F. Keifer, P. C. Ackerman, James Kempster, George F. Porter, Charles W. Price, E. E. Bartlett, J. R. Lovejoy, Alex. Henderson and Morris W. Mead.

At the conclusion of the dinner, with much joviality, and on motion of Mr. C. O. Baker, warmly seconded by Mr. James Kempster, Mr. Huntley was unanimously elected permanent annual host of the gathering, and then, with clasped hands, all united in singing "Auld Lang Syne."



DINNER OF MR. CHARLES R. HUNTLEY TO OLD-TIME ELECTRICAL ACQUAINTANCES, DELMONICO'S, OCTOBER 12, 1907.

Increase in Production and Exportation of Japanese Copper.

Referring to the export of copper from Japan, Consul-General H. B. Miller, of Yokohama, furnishes the following statistics from an Osaka, Japan, paper:

The total shipments of copper last year compared with the two previous years were as follows:

Year.	Pounds.	Value.
1904	46,537,509	$6,453,000
1905	45,386,809	8,034,000
1906	75,481,152	12,502,000

The largest exportations last year were from Kobe, which port handled 45,122,156 pounds, of which 17,935,030 went to Hongkong, 6,515,130 to China, and 1,181,044 to the United States, while the balance went to European countries. Since the demand of the Chinese Government ceased, the copper trade in Osaka has been almost completely transferred to Kobe, on account of the great activity in the shipment to Europe. There has been an increase in the shipments to Europe this year, and up to the end of July the value exported from Kobe amounted to $6,654,000.

THE RAILWAY SIGNAL ASSOCIATION.

ANNUAL MEETING, MILWAUKEE, WIS., OCTOBER 8, 9 AND 10.

The first session of the annual meeting of the Railway Signal Association was called to order in the Public Service Building, Milwaukee, Wis., Tuesday, October 8, at 10 A. M., President J. A. Peabody, Chicago & Northwestern Railway, presiding. Upon the session being called to order the Honorable Sherburn M. Becker, mayor of Milwaukee, delivered an address of welcome, to which the president responded. The president's address was next in order, after which the regular order of business was considered, the first item being the consideration of minutes of previous meeting, which were adopted as printed.

The secretary then made a statement to the convention that, in accordance with instructions received at one of the meetings of the executive committee, a register had been prepared and placed in an anteroom adjoining the auditorium, for all members to register and advised all members to take advantage of the same and place their names therein; also announced that banquet tickets could be procured at secretary's desk.

Under head of new business there was nothing to report.

Next in order was the report of the special committee on "Changes and Constitution." After some discussion the report of the committee was accepted as a whole.

Next in order was the report of committee No. 8, "Standard Specifications for Electric Interlocking," L. R. Clausen, Chicago, Milwaukee & St. Paul Railroad, chairman. The discussion on this consumed about four hours. Minor changes were made in some of the paragraphs, principally changing of the wording and not of the meaning, up to page 23, leaving the remainder of the report to be considered during the year and a further report to be presented at the annual meeting in 1908. On Wednesday morning there were reports of committee No. 1, "Automatic Block Signal Systems," and of committee No. 6, "Costs and Estimates for Installation."

The afternoon was devoted to the report of the special committee on "Signaling." Diagram No. 1 was taken up and considered, and it was decided to eliminate "No. 4—Stop Within Certain Limits." On "Requisites of Installation" it was decided that instead of having the table along the "Requisites" giving indications as to which kind of signaling it referred to, this should be repeated under their various heads. This would mean that with some of the requisites it would be necessary to repeat them five times. After discussing this at some length, and closing time arriving, motion was made and carried that the report be referred back to the committee for further action.

On Thursday morning the report of committee No. 4, "Standard Specifications for Automatic Block Signaling," was accepted as a progress report, and referred back to the committee.

Committee No. 14, "Foreign Current on Automatic Block Signaling," was taken up and after some discussion was accepted and the committee discharged.

Committee No. 11, "Signal Lamps," was taken up and accepted as a progress report.

Committee No. 2, "Maintenance of Automatic Block Signals," was taken up and an hour devoted to the discussion, all speakers considering it a very able report. Finally it was carried that the report be accepted and be printed in the minutes of the proceedings for the benefit of the members.

Report of committee No. 12, "Rubber Covered Wire and Cables," was taken up and a very spirited discussion on the subject was maintained for one hour, and as the closing time had arrived the discussion closed with the action of the convention that the report be referred back to the committee and that the report of 1906 be continued until further action can be taken.

The next business was the selection of meeting place for 1908, Washington, D. C., being selected on first ballot.

The election of officers resulted as follows:

President, A. H. Rudd, Pennsylvania Railroad, Philadelphia.

Senior vice-president, C. R. Clausen, Chicago, Milwaukee & St. Paul Railway, West Milwaukee.

Junior vice-president, H. S. Balliet, Grand Central Station, New York.

Secretary-treasurer, C. C. Rosenberg, Bethlehem, Pa.

Eastern representative, F. P. Patenall, Baltimore & Ohio Railroad, Baltimore, Md.

Western representative, C. E. Denny, Lake Shore & Michigan Southern Railroad, Cleveland, Ohio.

Meeting adjourned to meet at Washington, D. C., October 13, 14, 15, 1908.

There were 300 members and seventy ladies present.

The Signal Appliance Association entertained the ladies by theatre parties, trolley rides, etc. The annual banquet was held at the Hotel Pfister, Wednesday evening, with 280 in attendance.

The appliance manufacturers and supply houses made exhibits and were represented as follows:

The Rail Joint Company—E. F. Schermerhorn, G. A. Hagar, V. C. Armstrong, R. W. Smith, W. E. Clark, S. J. Collins, L. F. Braine.

Railroad Supply Company—E. W. Vogel, S. Deutsch, C. B. Cogswell, Jr.

General Electric Company, signal apparatus—F. B. Corey, A. W. Jones.

Duplex Metals Company, wire—A. P. Eckert.

Westinghouse Machine Company, storage battery—D. C. Arlington.

General Storage Battery Company—Wilbur H. Young, J. L. Jones.

The Adams & Westlake Company, lamps—G. A. Walters, Alexander S. Anderson, William J. Piersen, H. G. Turney, C. B. Carson.

Gordon Battery Company—E. M. Deems.

The American Railway Signal Company—George L. Weiss, H. M. Abernethy, J. L. Burrows, H. D. Abernethy, R. Eisman.

Northwestern Manufacturing Company, signal supplies—W. Stark Smith, F. W. Ells.

Fairbanks, Morse & Company, gas and gasolene engines—A. A. Taylor, J. A. Steele, F. von Schlegell, R. A. Patterson, W. J. O'Neill.

W. F. Bossert Manufacturing Company, adjustable switch brace—W. F. Bossert.

Electric Storage Battery—G. H. Atkin, T. B. Entz, M. E. Beck, W. F. Bauer.

Continental Signal Company—George H. Paine, W. A. D. Short, H. E. Brashares, Gaylord Thomas.

Battery Supplies Company—E. G. Dodge, president; E. E. Hudson, F. J. Lepreau.

The Union Switch and Signal Company—H. G. Prout, vice-president; J. S. Hobson, S. G. Johnson, W. M. Vandersluis, Lee Holliday, T. H. Patenall, G. Blackmore, H. W. Griffin, L. F. Howard, W. E. Foster, T. G. Wilson, A. G. Wilson, C. B. Gracey, C. F. Porteous, C. C. White, W. H. Cadwallader.

The Wilson Company, publishers—J. N. Reynolds.

Bryant Zinc Company, signal supplies A. F. Klink, president; M. R. Briney,

H. J. Hovey, R. I. Baird, A. B. Weeks, C. B. Schoenmehl.

American Vulcanized Fibre Company—John Barrows.

Edison Manufacturing Company, batteries—W. M. Brodie, C. W. Patrick.

Railway Specialty and Supply Company, signal supplies—P. W. Moore, F. A. Preston.

Quincy, Manchester, Sargent Company, insulated and rail joints—G. C. Isbester.

Federal Railway Signal Company—L. Griffith, A. Dean, H. H. Cade, C. Henze.

Stevenson Electric Switch Company—A. E. Stevenson.

Railroad Gazette—L. B. Sherman.

McClintock Manufacturing Company, signal apparatus—E. McClinton, W. M. McClintock, Chas. H. Decker.

Dressel Railway Lamp Works, lamps—J. M. Brown, F. W. Edmunds.

Galena Oil Company, illuminating oils—J. W. Bunn.

Corning Glass Works—T. C. Cameron.

C. H. Whall & Company, fibre—F. H. Whall.

Handlan Buck Manufacturing Company, lamps—A. J. Handlan, Jr., W. W. Bentz.

The Railway Equipment and Publishing Company—J. Alex. Brown.

Hall Signal Company—W. J. Gillingham, Jr.

Gould Storage Battery Company—H. N. Powers, G. G. Milne.

General Railway Signal Company—H. M. Sperry, George McDonough, J. L. Langdon, Ed. Halbleib, F. M. Moffett, W. K. Howe, L. Thomas.

Hayes Manufacturing Company, derailing switches—S. W. Hayes, W. H. Davis.

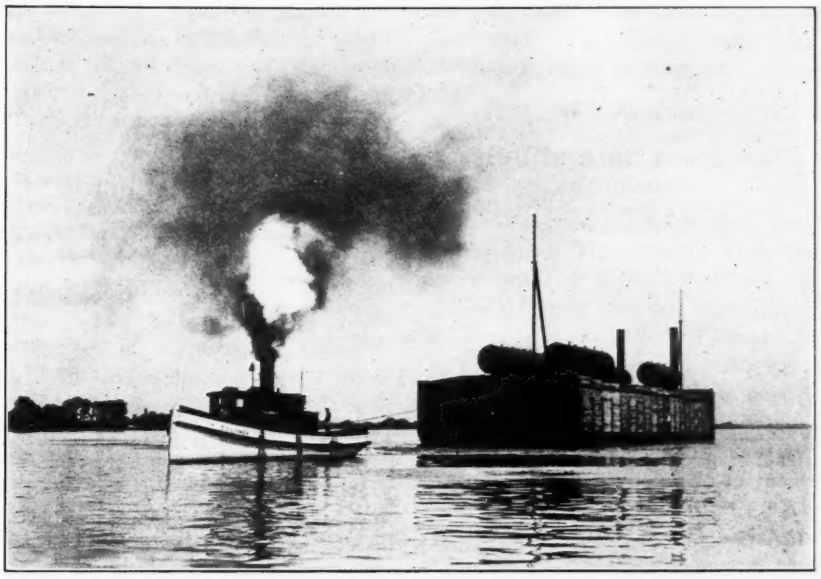
The Supply of Hard Wood.

Although the demand for hard-wood lumber is greater than ever before, the annual cut to-day is a billion feet less than it was seven years ago. In this same period the wholesale price of the different classes of hard-wood lumber has advanced from twenty-five to sixty-five per cent. The shortage of hard-wood lumber will cause dismay in a number of industries, particularly to the railroad, telegraph and telephone companies. This condition leads to the question, where is the future supply of hard woods to be found? The cut in Ohio and Indiana, which seven years ago led all other states, has fallen off one-half. Illinois, Iowa, Kentucky, Michigan, Minnesota, Missouri, New Jersey, Tennessee, Texas, West Virginia and Wisconsin have also declined in hard-wood production. The chief centres of production now lie in the Lake states, the lower Mississippi valley and the Appalachian Mountains. It would seem that the future production will lie in the Appalachian Mountains. They contain the largest body of hard-wood timber left in the United States. Protected from fire and reckless cutting, they produce the best kind of timber, since their soil and climate combine to make heavy stands and rapid growth. Rightly managed, the annual productive capacity of the 75,000,000 acres of forest lands in the Appalachians would be 20,000,000 feet of hard wood.

Circular No. 116 of the Forest Service, entitled "The Waning Hard Wood Supply," discussing this situation, may be had on application to the Forester, Forest Service, Washington, D. C.

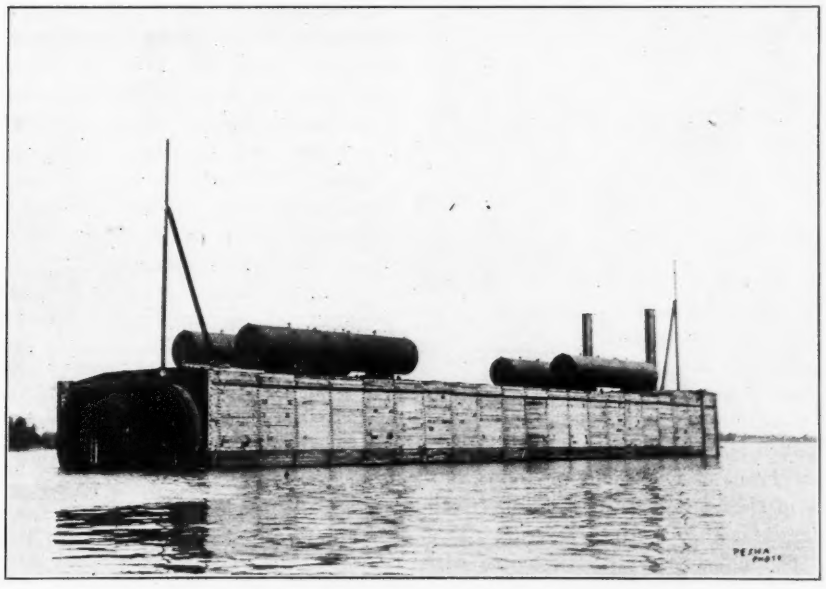
Caisson Sections for the Detroit River Tunnel.

The accompanying illustrations show two of the sections of the great Detroit river tunnel floating down the St. Clair river from the shipyard at St. Clair, Mich.



End View of Under-River Section, Detroit River Tunnel.

There will be ten sections, each 260 feet long, for a double track, each tube being twenty-three feet, four inches in diameter. These sections will be laid in a trench dredged in the bottom of the river, and encased in cement. The subaqueous portion of the tunnel will be 2,625 feet in length; the westerly open cut will be 1,540 feet; the westerly approach, 2,129 feet; the easterly approach, 3,193 feet, and the easterly open cut, 3,300 feet,



Side-View of Under-River Section, Detroit River Tunnel.

making the total length of excavation 12,786 feet. This is a trifle less than two and one-half miles.

The tunnel will cost $10,000,000, and it is stated will be completed by June, 1909. It is for the Michigan Central Railroad, and connects the United States with Canada under the Detroit river. The annual capacity will be 1,000,000 cars, increasing the present facilities over 300 per cent.

The Open Sale of Bell Telephones.

Last week a brief announcement was made of the intention of the American Telephone and Telegraph Company to offer the standard Bell telephone equipment, manufactured by the Western Electric Company, for sale in the open market. A Boston correspondent furnishes the following additional information:

"Henceforth, it appears that the management of the Bell system is going to make a sharp distinction between two departments of its activities. On the one side it is going to sell telephonic apparatus to all comers; on the other side it will deal in telephone service, including, where that is desired, the rental and maintenance of instruments. Anybody, who has the price, can get Bell telephones now, and in any number. If a householder wants to secure two telephones and the appropriate apparatus with which to connect house and stable he will be supplied with what has become recognized as a great improvement on the speaking tube. If an independent organization wants to purchase a million telephones with all the allied apparatus it can secure just the same plant as the companies of the Bell system possess. Whether these telephones will or will not be connected with the Bell companies makes no difference so far as the sale of appliances goes. Already the Western Electric Company, the manufacturing associate of the Bell companies of the United States, has for some years supplied telephones to other countries and some forms of telephonic apparatus, outside of transmitter and receiver, to private interests in this country.

"The difficulty up to this time with making this broad policy general has been that the Western Electric Company has needed more plant. Its full energies have been required to supply the demands of the Bell companies alone. The record of growth in the number of instruments in the hands of licensees and sub-licensees suggests the great efforts that have had to be made to keep up with the ever-increasing demand for Bell service. At the end of 1896 there were 772,627 instruments, transmitters and receivers being counted separately, in the hands of licensees. The number at the end of 1900 had grown to 1,952,412. On December 31, 1903, it stood at 3,779,517. By the end of 1905 it had reached 5,698,258, while the latest report of the American Telephone and Telegraph Company shows that at the beginning of the current year 7,107,836 instruments were interconnected in the Bell system, each one subject to maintenance and to replacement when worn out.

"To prepare for future demands and to execute the new policy, certain very large additions to the Chicago factory of the Western Electric Company have been made, so that it is now in a position to attend to the normal increase of the needs of the Bell companies and at the same time to take care of outside orders. President Theodore N. Vail, of the American Telephone and Telegraph Company, has said that no considerable direct increase of income is expected from this project, but that a great indirect advantage is foreseen from improved relations between the public and all the associated Bell companies, since there has been prevalent an erroneous idea that the charges of these companies for their services have been based on a monopoly of telephone instruments, whereas in reality the instrument is but a small part of the plant required in giving telephone service. The official statement that has just been published indicates that this change of policy may cause it to be more clearly understood than before by the public that the Bell companies' sole claim for patronage is based on their ability to furnish the best service at reasonable prices, and not on any instrument monopoly.

"As a new competitor among the manufacturers of telephonic apparatus for general sale the Western Electric Company represents one of the largest single electrical industries in the world. It was started in Cleveland in 1869 as a small instrument shop. It was moved the following year to Chicago, where in the days before Dr. Bell invented the telephone it was devoted largely to the manufacture of annunciators and telegraphic instruments. It later was a large producer of arc lamps, but during the remarkable expansion of Bell telephone projects it has come more and more to specialize on telephonic apparatus. Its scope is distinctly international, for at the present time the Western Electric Company owns and operates factories, warehouses and offices in the following cities: Chicago, New York, San Francisco, Philadelphia, Montreal, Antwerp, Berlin, London, Paris, Tokio, St. Petersburg, Vienna and Milan."

The Measurement of Electrolytic Resistance.

The following method of measuring electrolytic resistance without using electrodes was devised by W. S. Franklin and L. A. Freudenberger. It depends upon the use of a transformer, the primary of which is supplied with an alternating current, while the secondary consists of a single "turn" of liquid, the resistance of which is to be measured. This liquid is contained in a glass ring formed of two concentric cylinders with the edges ground plane and covered with two flat glass plates. In one arrangement for measuring the resistance a three-legged transformer core was employed, the electrolytic "turn" being placed around one outer leg and a secondary of wire around the other. The primary coil was wound in two parts so that when a current was passed through it and the secondary circuits were open, there would be no current set up in a test coil placed on the central leg and connected either to a telephone receiver or a special alternating-current galvanometer. Then when the glass vessel is filled with the electrolyte under investigation, the currents set up in this upset the magnetic balance of the system causing a current to flow in the test coil. By varying the resistance in the wire coil on the other outside leg the system could again be balanced and at this time the resistance in this circuit was equal to that of the electrolyte. Another arrangement consisted in employing two independent transformer cores with primary coils connected in series; around one the electrolytic conductor was placed, and around the other the wire secondary. With the two secondary circuits open an intermediate connection between the two transformers and the centre of an inductance connected between the supply mains should give rise to no current, but this balance is upset by filling the glass vessel with electrolyte and the balance again restored by means of the wire secondary. In these experiments a disturbing element is the eddy currents set up in the electrolyte. To allow for this, the glass vessel was filled about three-quarters full of the electrolyte and placed so that the circuit was not completed. In this way the disturbing effect of that amount of electrolyte was determined when that due to the total quantity could be computed. The observations made in this way gave results in good agreement with those of Kohlrausch and Holborn.—*The Physical Review.*

The Kendall Gold-Mining Fly wheel Motor-Generator Set.

In the September issue of the "General Electric Review," published by the General Electric Company's publication bureau, H. H. Clark gives a brief description of an interesting electrical hoisting equipment recently built by the General Electric Company for the Kendall Gold Mining Company, of Kendall, Mont.

This hoisting equipment was designed to raise 2,000 pounds of ore from a 1,000-foot level every 103 seconds when operating two drums, and every 170 seconds when a single drum only was in operation.

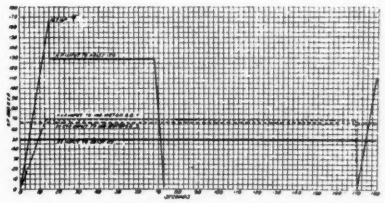


FIG. 1.—HORSE-POWER INPUT. UNBALANCED OPERATION.

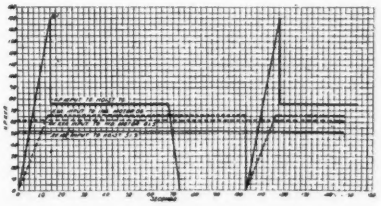


FIG. 2.—HORSE-POWER INPUT. BALANCED OPERATION.

The mine shaft has two compartments, and extends vertically to a depth of 1,000 feet. Two cylindrical drums are used, which are provided with the usual clutches for individual and combined running, each drum operating a compartment in which the weight of the rope is always balanced by an individual tail rope, whether the other compartment is working or not. This rope is one inch in diameter, and weighs 1.6 pounds per foot, the hoisting speed being 1,000 feet per minute. Each compartment is supplied with one skip weighing 1,400 pounds, and having a capacity of 2,000 pounds of ore.

Figs. 1 and 2 show the theoretical curves of horse-power input to the hoist, both when running one compartment (unbalanced operation) and two compartments (balanced operation). From these curves the unusual demand which occurs during the period of acceleration is made very apparent.

The capacity of the generating station being somewhat limited, the large rush of current incident to starting and accelerating the hoist tends to produce undesirable voltage fluctuations in the system, and the equipment here described was designed to eliminate this trouble and improve the regulation of the line.

To this end an outfit was supplied which permits of the most perfect speed control, allowing the load to be accelerated as rapidly or as gradually as desired. The equipment was also supplied with a means of equalizing the demand upon the power system, so that instead of being intermittent in character it is practically constant.

The system of control has the further great advantage of electrically braking the load in a manner which not only gives complete control over the retardation of the moving parts of the hoist, but also returns a considerable portion of their kinetic energy to the flywheel.

The hoist equipment comprises a shunt-wound direct-current motor, arranged to be geared to the hoisting drums, the motor receiving its power from a motor-generator set driven from the main power system. This set consists of an induction motor, and a direct-current generator, with a flywheel swung between them, and a direct-current exciter overhung at one end of the set. The function of this latter machine is to excite the field of the generator and that of the direct-current hoist motor. The speed and direction of rotation of the latter machine is controlled by varying the field strength of the direct-current generator by means of a rheostatic controller, which is conveniently located for the hoist operator.

In this set the induction motor is a three-phase, sixty-cycle, form M variable-speed machine, while the direct-current generator is provided with commutating poles, and is designed for operating with a very weak field at all loads.

Fig. 3 shows the diagram of connections of the complete equipment.

The flywheel is a steel casting, machined all over and perfectly balanced; it weighs about 12,000 pounds and operates at a peripheral speed of about 18,000 feet per minute. The wheel is used to store energy when the hoist is not in operation, and is called upon to give up this energy when the demand on the line is at a maximum.

In order to obtain this effect on the part of the flywheel of alternately storing and surrendering energy, the induction motor is arranged for variable-speed operation; changes in speed being automatically controlled by the variation of the main line current, which is led through a small three-phase regulating motor operating a water rheostat in series with the secondary winding of the motor.

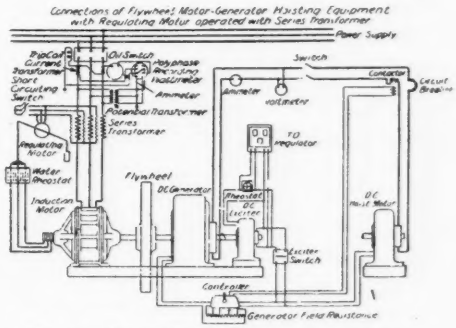


FIG. 3.—DIAGRAM OF CONNECTIONS OF FLY-WHEEL MOTOR-GENERATOR HOISTING EQUIPMENT.

The torque which is produced by the full-load value of the main-line current in the windings of the regulating motor is exactly balanced by the weight of the moving parts of the water rheostat, so that there is no change in the resistance that is in series with the rotor winding of the motor-generator set so long as the motor is taking full load current. If, however, it should demand more or less, there is an immediate movement of the water rheostat, tending to accelerate or retard the speed of the motor-generator set to such a point that the induction motor once more takes full load, and the movement of the water rheostat is stopped.

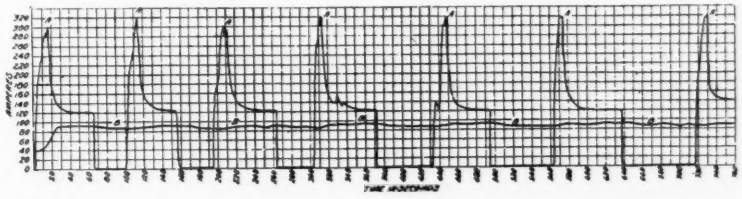


FIG. 4.—CURVE A, CURRENT INPUT OF HOIST MOTOR; CURVE B, CURRENT INPUT OF INDUCTION MOTOR OF MOTOR-GENERATOR SET.

The voltage of the exciter is maintained at a constant value during the speed variation of the motor-generator set by means of a Tirrill regulator.

Referring once more to Figs. 1 and 2, attention is called to the curve which shows the kilovolt-ampere input to the induction motor when a flywheel generator set is used. In these curves the un-

desirable starting peak has entirely disappeared; it was to secure this result that this equipment was designed.

Fig. 4 shows the curves of current input to the hoist motor and induction motor that were obtained from actual test, carried on at the works of the General Electric Company under conditions of load approximating, as nearly as possible, those which the set would be required to meet after installation at the mine. This figure shows very clearly indeed, how well the automatic devices perform the duty required of them, keeping the demand on the line practically constant, while the hoisting motor was called upon for several times its full-load capacity.

This equipment has now been installed for several months, and is operating to the complete satisfaction of the purchasers, as evidenced by letters received from their engineers commenting upon the behavior of the outfit.

"For California."

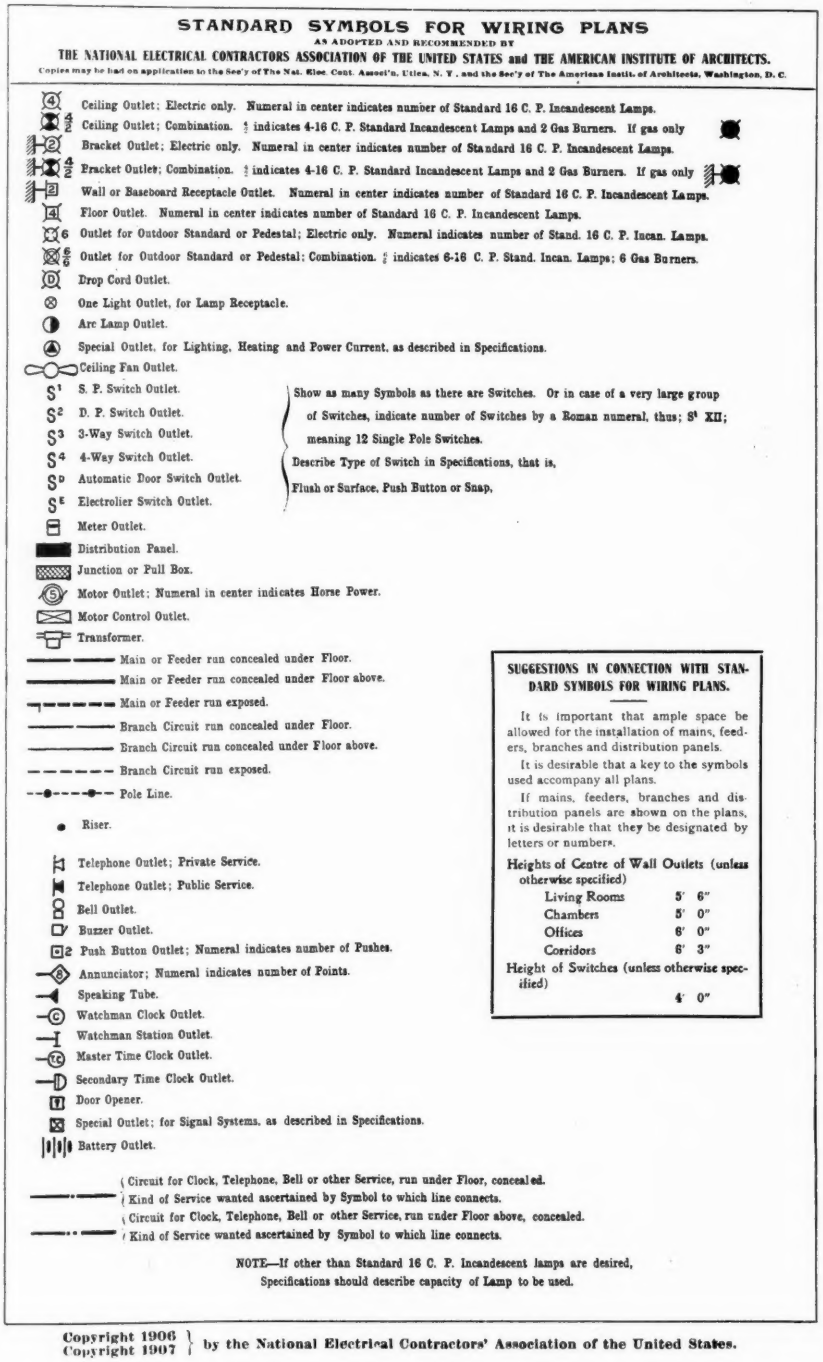
The October number of the magazine *For California,* published by the California Promotion Committee, is devoted to electric traction in the state. Few general readers are aware of the strides made recently in the production of electric power from California's mountain streams, or the extensive and highly diversified uses to which the current is being applied in manufacturing and transportation.

This greatly extended use of electricity as a cheap and perfect motive power has been made possible by the late improvements in transmission. It is now possible to send electric power, generated in some cañon well up in the Sierras, several hundred miles to the cities and valleys, and to the busy manufacturing area surrounding San Francisco Bay.

An article is contributed by J. M. Eddy, on Stockton's electric railways; electric traction in Los Angeles county is outlined by H. S. Kneedler; William Robertson writes of electricity in the development of Fresno county; Clarence E. Edwords contributes a page on the use of electricity on farms; Joseph T. Brooks tells about electric traction in Santa Clara county; and E. M. Van Frank writes in a similar vein on the electric traction of Sonoma county; there is an article on power from California mountain streams, by Walter J. Kenyon; an astonishing list of California power stations is given. Articles are contributed by staff writers on the "Development of Electric Traction of the State," "Electric Roads of San Bernardino County," and "Electric Traction in the Sacramento Valley." A page is given to "Promotion Paragraphs." The frontispiece of this number shows a typical California power-house, mountain stream and tail-race.

Standard Symbols for Wiring Plans.

The accompanying illustration shows the standard symbols for wiring plans which have been adopted by the National Electrical Contractors' Association of the United States, the American Institute of Architects, the Supervising Architect's office of the United States, the Quartermaster-General's office of the United States Army, and several municipal departments and technical institutions. The first edition of these symbols was illustrated some time ago in the ELECTRICAL REVIEW. Since that time changes have been made in the symbols for centre and bracket outlets, and symbols for indicating gas outlets have been added. Also, under the heading, "Suggestions," standard heights of wall outlets have been enumerated. These changes and additions were made at the instance of the American Institute of Architects.



STANDARD SYMBOLS FOR WIRING PLANS

AS ADOPTED AND RECOMMENDED BY

THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION OF THE UNITED STATES and THE AMERICAN INSTITUTE OF ARCHITECTS.

Copies may be had on application to the Sec'y of The Nat. Elec. Cont. Assoc'n, Utica, N. Y., and the Sec'y of The American Instit. of Architects, Washington, D. C.

Ceiling Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Ceiling Outlet; Combination. ½ indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners. If gas only

Bracket Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Bracket Outlet; Combination. ½ indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners. If gas only

Wall or Baseboard Receptacle Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Floor Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Outlet for Outdoor Standard or Pedestal; Electric only. Numeral indicates number of Stand. 16 C. P. Incan. Lamps.

Outlet for Outdoor Standard or Pedestal; Combination. ½ indicates 6-16 C. P. Stand. Incan. Lamps; 6 Gas Burners.

Drop Cord Outlet.

One Light Outlet, for Lamp Receptacle.

Arc Lamp Outlet.

Special Outlet, for Lighting, Heating and Power Current, as described in Specifications.

Ceiling Fan Outlet.

S¹ S. P. Switch Outlet.
S² D. P. Switch Outlet.
S³ 3-Way Switch Outlet.
S⁴ 4-Way Switch Outlet.
S^D Automatic Door Switch Outlet.
S^E Electrolier Switch Outlet.

Show as many Symbols as there are Switches. Or in case of a very large group of Switches, indicate number of Switches by a Roman numeral, thus; S¹ XII; meaning 12 Single Pole Switches.

Describe Type of Switch in Specifications, that is, Flush or Surface, Push Button or Snap.

Meter Outlet.

Distribution Panel.

Junction or Pull Box.

Motor Outlet; Numeral in center indicates Horse Power.

Motor Control Outlet.

Transformer.

Main or Feeder run concealed under Floor.

Main or Feeder run concealed under Floor above.

Main or Feeder run exposed.

Branch Circuit run concealed under Floor.

Branch Circuit run concealed under Floor above.

Branch Circuit run exposed.

Pole Line.

Riser.

Telephone Outlet; Private Service.

Telephone Outlet; Public Service.

Bell Outlet.

Buzzer Outlet.

Push Button Outlet; Numeral indicates number of Pushes.

Annunciator; Numeral indicates number of Points.

Speaking Tube.

Watchman Clock Outlet.

Watchman Station Outlet.

Master Time Clock Outlet.

Secondary Time Clock Outlet.

Door Opener.

Special Outlet; for Signal Systems, as described in Specifications.

Battery Outlet.

Circuit for Clock, Telephone, Bell or other Service, run under Floor, concealed. Kind of Service wanted ascertained by Symbol to which line connects.

Circuit for Clock, Telephone, Bell or other Service, run under Floor above, concealed. Kind of Service wanted ascertained by Symbol to which line connects.

NOTE—If other than Standard 16 C. P. Incandescent lamps are desired, Specifications should describe capacity of Lamp to be used.

SUGGESTIONS IN CONNECTION WITH STANDARD SYMBOLS FOR WIRING PLANS.

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans, it is desirable that they be designated by letters or numbers.

Heights of Centre of Wall Outlets (unless otherwise specified)

Living Rooms	5′ 6″
Chambers	5′ 0″
Offices	6′ 0″
Corridors	6′ 3″

Height of Switches (unless otherwise specified) 4′ 0″

Copyright 1906 } by the National Electrical Contractors' Association of the United States.
Copyright 1907 }

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

DISCUSSION OF GROUNDING THE NEUTRAL POINT OF TRANSMISSION SYSTEMS.

The first fall meeting of the American Institute of Electrical Engineers was held in the auditorium of the Engineering Societies Building New York city, on Friday evening, October 11. President H. G. Stott called the meeting to order and delivered his inaugural address, abstracts of which follow:

Before entering upon the presentation and discussion of the papers prepared for this occasion, we may profitably pause for a few moments to consider the aims and objects of this society, as set forth in Article I of our constitution, and how we have accomplished them in the past, and how we may endeavor to meet them more fully in the future.

The American Institute of Electrical Engineers to-day has over 5,100 members, of whom approximately ninety per cent are residents of this country and ten per cent residents of foreign countries. Of the 4,600 domestic members, approximately twenty-two per cent reside within one hour's travel of our national headquarters, and seventy per cent within a distance which can be covered in twelve hours or less.

Our proceedings and transactions, available to all, undoubtedly are the most valuable asset of membership, but next to that may we not say that the social side ranks in value? It is obviously impossible for us all to meet one another, as our domestic membership alone is distributed over a territory of 2,970,000 square miles. To meet this difficulty, the sections and university branches have been organized, so that now, besides the national headquarters in New York, we have twenty sections and seventeen university branches located at all great centres of membership. At these sections and branches not only are the papers presented at the New York meetings discussed, but original papers are also presented and discussed. Papers presented at sections will, when forwarded to the Papers Committee, be disposed of in exactly the same manner as if presented for the New York meeting.

In accordance with the terms of the new constitution, now in force, the chairmen of all sections are *ex officio* members of the Sections Committee, and have the right to appear before the board of directors at any of their meetings, for the purpose of conference in regard to any matters pertaining to the affairs of the Institute in their sections.

It will thus be seen that we are gradually evolving an organization somewhat similar to that of our state and Federal governments, and as the process of evolution goes on, the constitution may have again to be readjusted to meet the new conditions.

Article I of our constitution says:

"1. The name of this association is the American Institute of Electrical Engineers.

"2. Its objects shall be advancement of the theory and practice of electrical engineering and of the allied arts and sciences and the maintenance of a high professional standing among its members. Among the means to this end shall be the holding of meetings for the reading and discussion of professional papers and the publication of such papers, discussions and communications as may seem expedient."

When we look back over our transactions for the last ten years, we can not help being struck by the admirable way in which we find there recorded almost everything of note which has contributed to "the advancement of the theory and practice of electrical engineering," but so rapid has the evolution of the theory and practice of electrical engineering been, that the "allied arts and sciences" have been to a large extent squeezed out. With every new application of electricity comes the demand for men who are not only specialists in that particular art, but who at the same time are electrical engineers, as for example in the applications of electricity to electrochemical processes, railways, illumination, transmission of power, mining, utilization of electricity in the numberless manufacturing processes, all of them calling for highly specialized knowledge in the allied arts.

It would therefore seem as if the time is now ripe for carrying out all the objects mentioned in our constitution, and the Papers Committee is now endeavoring to broaden the scope of the Institute work without allowing its efforts to scatter too much. In order to assist in this work, some of the committee work has been reorganized, for example, the old High-Tension Transmission Committee, which has done such excellent work, now becomes a sub-committee of the Papers Committee, and a new sub-committee on railways has been formed. This reorganization will, it is hoped, relieve the Papers Committee, and coordinate the work which previously had a natural tendency to duplication under two independent committees. Additional sub-committees will be appointed as necessity seems to require.

In accordance with the unanimous vote at the last annual convention, the board of directors has authorized the appointment of a Committee on Education to cooperate with other education committees in recommending a syllabus of studies for electrical engineers at our universities.

In furtherance of this work, a special meeting devoted to educational subjects will be held toward the end of this year, when those in charge of educational work will be free to devote some time to this most important subject.

In conjunction with educational work, we have available to our members not only our own library, but also those of the American Society of Mechanical Engineers and the American Institute of Mining Engineers, aggregating approximately 30,000 volumes, and forming the most valuable collection of technical works in the world. This joint library, however, is only open from 9 A. M. to 5 P. M., and is therefore of very little value to the majority of members, who are unable to spare time from their various vocations between these hours; but a movement is now on foot to change the present organization so as to make the library available up to 10 P. M., and thus enable our members to make full use of this great opportunity to consult the best authorities on any engineering subject.

When distinguished foreign engineers visit this country, we have had no person or persons who could officially welcome them in the name of the American Institute of Electrical Engineers, so that this duty or pleasure has fallen heavily upon a small number of members, who have on numerous occasions acted as an unofficial reception committee. It would seem as if it would lend to the dignity of these receptions, while giving authority to our members who are willing to incur the necessary expenditure of time and money, if a strong representative reception committee were appointed in each large city, so that our guests could be passed on from one city to another and thereby be saved a great deal of trouble, by finding immediately where they could see the particular apparatus or get the information they desired.

In conclusion, it now seems probable that our annual banquet will be held in January, when we hope to have several distinguished guests address us, and I trust that the members of the American Institute of Electrical Engineers will remember that not only in our technical

work, but in our social work, your officers whom you have elected need your constant support and encouragement.

The following papers were then presented by the authors: "The Grounded Neutral, with and without Series Resistance in High-Tension Systems," by Paul M. Lincoln; "Experience with a Grounded Neutral on the High-Tension System of the Interborough Rapid Transit Company," by George I. Rhodes; "Experience with the Grounded Neutral," by F. G. Clark. Abstracts of these papers are given elsewhere in this issue.

The discussion was opened by a communication from Frank G. Baum, which was read by P. H. Thomas. This gives the following advantages of a grounded Y connection over delta for high-voltage transmission (from 60,000 upwards).

1. We reduce the transformer potential in the ratio of $\frac{1 - .58}{1.732 - 1}$, and for very high potentials the transformers may be designed for reinforced insulation on one end of the transformer only, making them safer and cheaper.

2. The maximum potential on all insulators, switches, etc., is 42.2 per cent lower than with delta connection under normal and abnormal conditions.

3. The station wiring is simpler.

4. Small consumers may be supplied with one or two transformers.

Experience for a number of years with several large transmission systems operating at voltages from 10,000 to 75,000, both delta and Y, demonstrate that, where the systems are properly installed, there is no more difficulty in operating one than the other. Most of the troubles of the early transmission systems came from lack of insulation, and with the improvement in insulation there disappeared nearly all the troubles variously ascribed to static, lightning, ground currents, telephone and telegraphic interference, etc.

A communication from O. S. Lyford, Jr., was also read by Mr. Thomas. In part this says:

The grounded neutral is a sort of antitoxin, administered not to prevent the initial distemper, but to keep it from spreading. The danger is that the remedy will prove more serious than the disease, or that the handicap to the general elasticity of the system will be greater than the immunity obtained.

When the neutral ground is adopted, its group of evils is accepted as the lesser of two. There is greater flexibility and greater convenience in the use of apparatus if the system is ungrounded. This advantage has led to the use of delta-connected transformers in the great majority of transmission systems and this grouping of transformers prohibits the use of neutral ground except by adding more transformers from which a neutral connection may be brought out.

As has been stated, the grounding of the neutral does not decrease the normal working strains or reduce the number of initial disturbances; furthermore, it does not prevent the first surges which may follow an insulation failure. When used, it is generally in the hope that it will minimize the abnormal voltage between line and ground and insure prompt action of the automatic circuit-breakers which will cut off the defective circuit before the damage is extended or the system as a whole shut down. There are many cases where even the subsequent troubles may not be prevented by a grounded neutral. Several such instances were described.

It is an interesting fact that three of the most important systems, one of which was started without a neutral ground, and two of which were started with neutral dead grounded, have for different reasons subsequently adopted a neutral ground through a resistance or resistances.

For the general case, it may be said that the ungrounded system is preferable, the exception being where there are special conditions which make an interruption of service on a particular circuit of less importance than the consequence if the defective circuit is not immediately cut off. If the system is a large one and conditions necessitate a neutral ground, present experience indicates that there should be a resistance in the neutral circuit.

P. Junkersfeld said the Commonwealth-Edison Company, of Chicago, operates a total of about 800 miles of three-phase overhead and underground lines at voltages of 4,000, 9,000 and 20,000 volts in various zones and for different purposes, on all of which the neutral is connected to ground either with or without a resistance. The experience in operating high-tension systems with neutral grounded has, therefore, been considerable, and the engineering policy on this matter has been rather definite for several years. The experience, however, in grounding such neutral through a resistance has still been very limited. The results from this grounded system have been very satisfactory. There have been practically no underground cable burnouts on this sixty-cycle system and comparatively little trouble on pot-heads or on the other overhead construction. The total number of transformer burnouts from all causes, including lightning, overloading and defects in the apparatus, during the past two years has been about 1.4 per cent and 1.2 per cent of the total number of line transformers in service. The percentage expressed in kilowatt-capacity connected has thus far been slightly less.

The 9,000-volt, twenty-five-cycle transmission system in Chicago is used exclusively for transmission to substations and not for general distribution. With the exception of a few induction motor-driven exciters all equipment consists of rotary converters or synchronous motor generators. The neutral of this system was connected solidly to ground in May, 1902, when the first twenty-five-cycle, 9,000-volt generators were started at the Harrison street station.

During the past five and one-half years, even after eliminating all cases of trouble which have no bearing on this subject of grounded neutral, there have been four serious cases and a number of minor ones which have a strong bearing on the matter of grounded neutral. Especially is this true of cable troubles which, during the past three years, have averaged only two cases per one hundred miles per year.

The company has started some investigations with the oscillograph and has also installed, for purposes of observation, some spark-gaps at different points on the system, all with special reference to securing more accurate information for guidance in the development of the 20,000-volt underground system into suburban districts. These investigations have not yet progressed sufficiently to afford much definite information. But these investigations and the experience in Chicago with one system for five years, and another system for seven years, lead the engineers to believe, as between operating with the neutral grounded or not grounded, that the neutral grounded is the better policy. As to whether or not any additional benefits would be secured by grounding the neutral through a resistance, their experience is still too limited to say.

Philip Torchio described the experience of the New York Edison Company's system, which is operated at a moderately high voltage, but without a grounded neutral. It is the opinion of the engineers of this company that in their experience they have not found as yet enough evidence either of the necessity or the desirability of grounding the neutral of 6,600 or 11,000-volt high-tension systems operated under ground. The Edison sys-

tem operates at 6,600 volts, three-phase, twenty-five cycles.

N. J. Neall discussed the effect of grounding with or without resistance, from the lightning protection apparatus standpoint. In general, we are not very much concerned about the lightning protection for an underground system, as no arrester or arrester scheme between the conductors and the ground will be of any great benefit. But the question of lightning protection for overhead systems of high voltage has as much bearing on the selection of a grounded neutral as any other one element of operation. Manufacturers in general follow rather than lead in the adoption of high-voltage protective apparatus; and to ground the neutral, will throw the arrester ratings into a group which has been but partially developed; moreover, the question of insulators for these high voltages is also an important element in the selection of the method of connection. Neither a grounded nor an ungrounded neutral will save the puncturing of insulators by high-voltage strains induced by lightning.

Another element of line operation which is not helped very much by grounding is the telephone plant. One of the most serious conditions in long-distance transmission at the time of any disturbance is the interruption of telephone service within the transmission system itself.

J. B. Taylor pointed out that the burnouts per mile per cable per year, computed from Mr. Rhodes's paper, agree with the figures, based on breaks per 100 miles of cable per year, given by Mr. Junkersfeld.

C. Schwartz agreed with Mr. Lincoln's conclusions, and described a large system in which the neutral is grounded through resistance. However, partly owing to the fact that the system is in operation for a comparatively short time, not very extensive experience has been gained. So far no trouble has occurred and no reasons against the arrangement adopted or objectionable features have appeared. There are on this system two power stations, ultimately to contain six units of 5,000 kilowatts, 11,000 volts, three-phase, twenty-five cycles each, and eight substations, one power station with 20,000 kilowatts' capacity, and three substations being in operation at the present time. A bus of ground potential, 500,000 circular mils, grounded at both ends, runs through the station. To this are connected the neutrals of the individual machines through separate resistances. Disconnecting knife switches between machines and resistances allow their separation as may be required. The ground plates are of copper, about twenty square feet, and buried deep enough to be always under salt water. The resistances are constructed of cast-iron grids, set in iron frames on porcelain insulators, and enclosed in fireproof brick compartments, with proper ventilation. The resistance of each of them is about nineteen ohms, so that with a difference of potential between phases and ground of 6,300 volts about 330 amperes can flow through each resistance. Two to four resistances are to be used in parallel at one time.

C. W. Stone said grounding the neutral without a resistance contributes to the chance of short-circuits. Therefore, it seems advisable to put in a resistance to cut down the amount of current which can flow at this time. As a rule it is a bad plan to ground in more than one place. He mentioned the case of a lighting system operated with a ground, not only in the main station, but in different substations. The effect of that was, when a car started up in an outlying district, the fluctuation in lights was very serious, due to the flow of direct current from this grounded connection; the neutral gave a better grounded return than the rails. For grounding, we should use some resistance having practically no reactance; hence avoid iron grids.

F. B. H. Paine said there are some places where it is desirable to use a high resistance in the neutral in order to limit the current to a small amount, regardless of the amount of energy being sent out, or the number of conductors in service. The one particular case where it is desirable that the substation at the end of the line be connected to ground is where it is connected through fuses, or from individual wire breakers, to avoid raising the voltage in case one wire of the three becomes disconnected.

C. F. Scott said if we could have the ideal relay, reverse-current selective, etc., and the ideal circuit-opening apparatus, one which will open any circuit instantly and smoothly, then some of the precautions which have been assumed as necessary in the various papers would probably be unnecessary. This is a question which can be covered in theory and discussed on theoretical lines, indefinitely, but after the general conditions are stated then it becomes a problem of operation, which is the most successful method.

Mr. Lincoln, in closing the discussion on his paper, said there is no particular difficulty about obtaining a neutral on a delta system if an auto-transformer be used.

As suggested by Mr. Stone, putting a resistance in the neutral of each generator is the logical method of operating, because the resistance in each neutral (or path?) of the generator will limit the current which can flow through that particular generator. However, of more importance than the destructive effects on the windings is the damage which will occur at the point of breakdown. Limiting the damage at the point of breakdown is one of the great functions of putting resistance in the grounded neutral, and that damage at the point of breakdown requires a fixed resistance rather than a resistance dependent on the number of generators in circuit.

Mr. Rhodes said the object of having resistance in the separate generators' neutrals is to make the effect of the ground as small as possible on the rest of the system.

As to the reactance in the cast-iron grid: The particular resistance his company uses has something over six ohms' resistance, and the reactance at twenty-five cycles is approximately 0.3 ohm, which is small compared with the reactance of the generators themselves, and would have little effect in producing surges.

Dr. C. P. Steinmetz said while he does not believe in promiscuous grounding, there are many cases when there is a very great advantage in grounding the neutral of a three-phase system. The conditions in this respect are about as follows: First, the neutral of the three-phase system should not be grounded where grounding is not necessary; second, the neutral should be grounded where the conditions of the system are such that the system can not run safely when unbalanced electrostatically; third, that wherever it is not necessary to have more than one ground on the system, it is desirable to ground at one place only; fourth, whenever it is not safe to ground without resistance, resistance should be used. Practice differs, however, respecting what is and what is not allowable or desirable.

In a case in which it is doubtful whether to do one thing or another, it is usually safe to decide on that which is against the favored practice, for the reason that nobody can remain entirely unbiased in his judgment if the general trend of sentiment is in a certain direction, and where he therefore thinks the advantage about equal, he unintentionally in most cases favors that side which is the fad of the time, and it would therefore be fairly safe to decide in favor of the other side.

The meeting was then adjourned.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

An Improved Universal Shunt-Box.

A sensitive galvanometer is generally used with an appropriate shunt-box, allowing only a definite fraction of the current which is to be measured to be sent through the galvanometer. The well-known universal shunt-box designed by Ayrton and Mather can be applied to any galvanometer. This contains a resistance connected across the terminals of the galvanometer. The current to be measured flows through the tenth, one-hundredth, or one-thousandth part of this resistance. It can easily be shown that the sensitiveness of the galvanometer combined with the shunt is reduced in exactly the same proportion. As this holds good for any instrument, one would expect that one universal shunt-box could be used with advantage for every galvanometer. This, says J. K. A. W. Salomonson, is not the case, as the total resistance of the shunt-box should be neither too large nor too small as compared with the galvanometer resistance. This circumstance is particularly felt when a moving-coil instrument is used, as the damping is strongly influenced by the external resistance. For dead-beat deflections the external resistance should be much reduced, whereas periodic deflections are only to be obtained with a large external resistance. Practically, this means that there should be one shunt-box for every galvanometer of this kind. In order to be able to use the same universal shunt-box for every galvanometer, the author has modified it slightly. He adds to the box a dial switch which permits part of the resistance to be cut out of the galvanometer circuit, so as to reduce its total resistance. When this is done, the shunt powers are, of course, reduced in the same proportion and in a particular box having a total of 100,000 ohms' resistance and eleven shunt powers, by reducing the total resistance to 10,000, nine shunt powers are available, with 1,000 ohms' resistance there are seven, and with 100 ohms, 5. This modified shunt is particularly useful with moving-coil instruments as it allows the absolute sensitiveness, as well as the damping, to be modified.—*Abstracted from the Electrician (London), September 27.*

The Future of Electric Heating.

An attempt is made here to determine the relative use of electric heating apparatus among electric current consumers in England. The investigation is not complete since a number of the companies declined to go to the trouble of finding out how many of their customers were using heaters, but the figures given show that these are a comparatively small part of the total. The blame of this, it is said, must rest largely on the supply companies who make but little effort to increase the use of electric heaters. The consumer is not inclined to use a heater and to pay for the current for this purpose at the same rate at which he pays for lighting, nor is he inclined to go to the expense of putting in separate wiring so as to secure a lower rate. It is suggested that a compromise might be made, and some allowance given to those consumers who use heaters, although the way of determining what this allowance shall be is not given. The figures given are not up at the present time although they are the latest available. The increase in lighting consumers is said to be from ten to twenty per cent over the figures of the table, while the use of radiators is said not to have increased so greatly. A few figures will indicate the proportion of heaters employed. St. Marylebone, London, has about 7,000 consumers and but 317 using electric cooking apparatus; there are 431 radiators connected. Hampstead has 5,714 consumers, 322 using cooking apparatus and there are 900 radiators in service. Westminster, with over 8,000 consumers, has 800 using cooking apparatus and 1,200 radiators. The Metropolitan Electric Supply Company with 9,370 consumers has 332 using cooking apparatus and 656 radiators in service. Of the Provincial supply systems, Edinburgh has 9,355 consumers, 332 of whom are using cooking apparatus and there are 700 radiators in use. Glasgow has 13,705 consumers, and only 140 using electric cooking apparatus, and but 300 radiators connected. Manchester has 6,340 consumers, but 292 using cooking apparatus and 505 radiators. These figures, as is said, indicate but slight appreciation of the advantages of electric heating and cooking apparatus, and show what a large field there is to be cultivated if only the supply companies would undertake it.—*Abstracted from the Electrical Review (London), September 27.*

Distribution of Electricity in the Atmosphere.

The distribution of electricity in the atmosphere has generally been calculated on the assumption that the portion of the earth's surface considered is a plane, the equipotential surfaces in the atmosphere being planes parallel to it. This procedure, says Y. Homma, admits of only limited application of the results to the actual problems, and he proceeds to calculate the electrical distribution on another assumption, which, while still decidedly too simple to cover all the details occurring in the exceedingly complicated field of atmospheric electricity, may be taken as sufficient for the standard case, before we are provided with improved observational data from all quarters of the world. It is an established fact that, in the normal condition of the weather, the earth's surface is electrically negative, compared with points in the atmosphere. There have been many hypotheses offered in explanation of this phenomenon. One supposed that the earth was an insulated globe with an inherent negative charge upon its surface, the complementary positive charge being at an infinite distance. According to this assumption, the potential gradient ought to be sensibly constant within an elevation of a few kilometres, whereas according to observation, it is generally greater at the surface, and decreases rather rapidly from the surface upward, so rapidly that there is reason to suppose that at a comparatively moderate height, say six miles, it becomes practically zero. Kelvin and others have supposed that the positive complementary charge to the earth's negative charge is distributed on a spherical surface having the same centre as the earth, but this hypothesis leads to the same conclusion as the first, and hence must be abandoned. From these considerations, we are lead to locate the complementary positive charge either wholly or partially within the atmosphere itself. Hence, the following assumption is made: The earth is regarded as a spherical conductor with a negative

charge uniformly distributed over its surface; the complementary positive charge is wholly contained within the atmosphere, so that at a certain distance from the centre the potential is zero. The positive electricity in the atmosphere is concentrically distributed so that all equipotential surfaces are concentric spheres. Applying Poisson's equation to the assumption, five cases arise. It may be assumed that the positive electricity is distributed with constant density in the atmosphere, or that the positive electricity is so distributed that the density at any point is proportional to its radial distance from the earth's centre, or that the density is negative at the surface and continues so until near the surface, where it passes through zero and becomes positive, or, again, that the density at any point is proportional to its radial distance from the exterior spherical surface, so that it is greatest at the earth's surface and diminishes upward; or, finally, that the density decreases according to an exponential function of height, as is the case with the density of air, water vapor, or other gases in the atmosphere. The mathematical analysis of the problem as applied to these five assumptions, and the curves of potential gradient, referred to height, are plotted from them, the curves thus secured being compared with those plotted from actual experiments. The difficulty here lies in our little knowledge of the actual form of these curves, although they do not appear to be straight lines. The following are the conclusions drawn from this research, the one which seems most probable can be determined only by further experimental work. If the electric density be constant according to the first assumption, the curve representing the relation between the potential gradient and the height is a straight line. If the electric density in the upper layer of the atmosphere be greater than that in the lower, the curve will have its concave side toward the origin; while if the electric density in the lower layer be greater that that in the upper, the convex side will be turned toward the origin. The most reliable observational data point to a vague tendency of more electricity accumulating in the lower regions of the atmosphere than was assumed in these calculations, but more exact comparison between the calculated curves and those actually observed is needed. The absolute potential of the earth is of the order -10^6 volts, which is much smaller than -10^{10} volts obtained by Exner's method. —*Abstracted from Terrestrial Magnetism and Atmospheric Electricity (Baltimore), June.*

The Design and Testing of Electrical Porcelain.

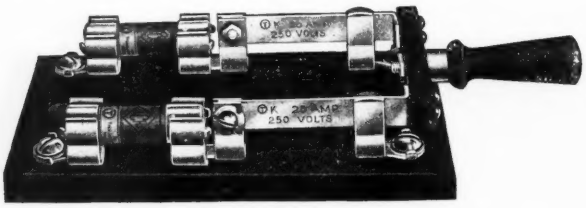
In constructing electrical insulators of porcelain high dielectric and great mechanical strength are required, especially for those types used in overhead lines. Careful designing, according to D. Harvey, is necessary to obtain the best results not only for service, but so that the article may be manufactured readily and economically. Often a slight change in design will not interfere with the usefulness of the apparatus and will render the porcelain much less difficult to manufacture. The price of porcelain necessarily includes both the actual cost of manufacture of the pieces used, and in addition the cost of pieces which are rejected. A large insulator is more expensive than a small one, not on account of the larger amount of material used, but because of the greater difficulty in the manufacture. The cost of porcelain is largely dependent upon the number of pieces which can be placed in the kiln at one time, as the cost of firing is practically the same, regardless of the amount of porcelain in the kiln. When glazed porcelain is fired, the pieces must be separated so that they will not be held together by the glaze. Glazed porcelain is more expensive to manufacture because of the extra operation of dipping in the glazing fluid, but it is more desirable as the glazed surface does not retain dirt and moisture so easily. The "dry process" of manufacture is suitable only for small simple pieces, which can be formed by means of metal dies. The "wet process" is used for insulators adapted to high voltages. They may be made in any form which can be made on a potter's wheel or turned in a lathe. "Wet process" porcelain costs more than the dry, when made in quantities, because it is made by hand, but is less expensive than the latter when only a few pieces are needed. The porcelain should be as nearly uniform in thickness as possible, as this facilitates uniform drying and renders the porcelain less liable to become cracked or warped. It is customary to allow certain variations in the dimensions of porcelain insulators from those specified. A reasonable variation for dry pressed ware is one and one-half per cent either way, or three per cent total. For the "wet process" double this allowance is made, because the ware is made by hand. Porcelain of the best quality is of very high dielectric strength. As the thickness increases, it becomes more difficult to obtain well vitrified ware without small cracks or other flaws in the interior. This fact practically limits the voltage which a single piece of porcelain can withstand, hence multiple-part insulators are used for higher voltages. Such insulators should be designed so that no single piece will be tested at more than 80,000 volts, and a somewhat lower test is desirable. There is a common impression that breakdown over a high-tension insulator is due to surface leakage. Unless the surfaces are wet or covered with some conducting material, there is no appreciable leakage of current, as the only current flowing is the charging current of the insulator considered as a condenser. The principal cause of breakdown seems to be the rupture of the film of air immediately adjacent to the insulator, on account of excessive electrostatic strain. When this occurs, the air becomes a semi-conductor, serving to extend the electrodes and therefore increase the current. This rupturing of the air and consequent increase in the electrodes and in the brush discharge tends to continue indefinitely, but is retarded by the cooling effect of the porcelain, its shape, etc. A slight increase in voltage will considerably extend the area of the brush discharge. The insulator may be shaped so that the surface of the porcelain is carried out into an electrostatic field so weak that the air adjacent to the porcelain can not break down, and thus this effect is limited. One advantage of porcelain over glass is its ability to withstand extreme weather conditions. A glass insulator, if not properly annealed, may be cracked and chipped by the heat of the morning sun after a cool night. Glass, however, has the advantage that mere inspection will locate defects, which in porcelain could only be determined by potential tests. The tests to which insulators are submitted should be made to correspond as nearly as possible to the conditions of service. It is customary to test porcelain parts at a somewhat higher voltage than they will be subjected to upon finished apparatus. Practice has clearly established the need of a time test in order to detect defects, the time usually being one minute. In order to detect the point at which the breakdown occurs, it is desirable to apply the testing voltage for a sufficient length of time to burn a hole. By connecting a circuit-breaker in series with the testing transformer arranged so that it will open upon the breakdown of an insulator and thus throw an impedence in circuit which will limit the current, it is easy to locate a defect without injury to the testing apparatus.—*Abstracted from the Electric Journal (Pittsburg), October.*

INDUSTRIAL SECTION

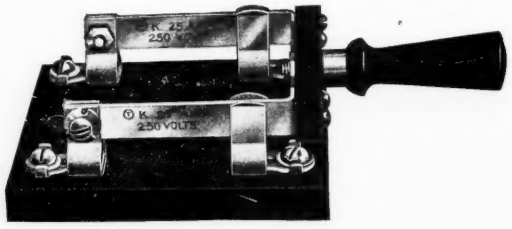
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Trumbull "Kappa" Switch.

The accompanying illustrations show the new "Kappa" switch recently placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Ct. This switch is made in twenty-five amperes capacity only, single-pole, double-pole and triple-pole, unfused or fused, for both enclosed and open-link fuses, and has been approved by the National Board of Fire Underwriters. It is designed for light work, and is intended to meet the demand for a very inexpensive switch which is at the same time very reliable.



TWENTY-FIVE AMPERE, NATIONAL ELECTRICAL CODE, FUSED.



TWENTY-FIVE AMPERE, UNFUSED.

GENERAL ELECTRIC COMPANY BUILDS FACTORY IN TWENTY-NINE DAYS.

BY CHARLES M. RIPLEY.

In these days of highly developed earning power, of factories overrun and behind with orders, together with the high real estate values on factory sites within a radius of twenty miles of New York, speed in construction, it can be plainly seen, is a necessary and valuable essential in a building contract.

There has recently been completed at Newark, N. J., a lamp factory for the General Electric Company. On the 24th of the month ground was first broken by the contracting firm doing the work, and on the 23d of the following month the building was finished, and the manufacturers' machinery was being installed —twenty-nine calendar days, no nights nor Sunday work and a half holiday on Saturdays for the skilled labor.

An additional feature of interest in the construction of this factory lies in the fact that an extra week's time had been granted to the contractors by the architect, of which the contractors did not avail themselves. The footings were originally specified as four feet six inches deep, but owing to the discovery that the factory site had previously been occupied by an old tannery, these footings had to be made sixteen feet and it was necessary to excavate large quantities of tan-bark. In spite of this handicap, the foundations in places being sunk to this additional depth, the contractors completed the work two days ahead of the original contract time and hence did not need the extra week allowed for the deeper foundations.

Another handicap which the contractors had to overcome, was the provision in the specifications that the foundations and walls of the first story should be strong enough to allow of three additional stories later on. This, together with the limitation of the ultimate pressure on the soil below, 5,000 pounds per square foot, made much heavier work necessary than would have ordinarily been the case on the one-story factory building.

The cost of the factory was approximately $50,000, with a bonus and forfeit clause, and in one week of five and a half days the pay roll amounted to $6,000. About this time 400,000 bricks were laid in eleven working days, or an average of some 36,000 bricks per day.

It is interesting to note that 280 men were employed in building this factory under the guidance of four brick foremen, four carpenter foremen, and four labor foremen. Two time-keepers were continually employed and one of the members of the contracting firm was always present.

Perhaps the most essential feature of this speedy construction, aside from the large force of men and ample superintendence, was the fact that the common Jersey hard brick, long-leaf yellow pine, Portland cement, window frames, trim and, in fact, all materials were purchased in Newark, N. J., for immediate delivery and trucked to the job. It is claimed by Mr. Salmond of the contracting firm, Salmond Brothers, that in no other way would it have been possible to have constructed this building in anything like the record time required, except by calling upon their local business acquaintances with personal appeals.

An amusing incident in connection with this work was the method employed in rushing the roofing work. At the same time that a four-inch tar concrete floor was being put in, two separate roofing contractors, one employing a Newark labor union, and the other a Brooklyn labor union, were engaged simultaneously on separate halves of the roof, racing one against the other. The good spirit of the workmen and the enthusiasm of the rival unions contributed largely to the remarkable record. History does not state whether Brooklyn or Newark prevailed in this competition, but it was a welcome streak of humor in what had up to that time been a nerve-racking ordeal for all concerned.

A temporary roofing of hemlock, together with the final covering and the four-inch tar concrete floor, was completed within four days.

Throughout the factory, standard mill construction was used; the girders rested upon post caps of the usual type. Posts of fourteen by fourteen inches, girders sixteen by sixteen inches and beams ten by sixteen inches were the prevailing unfinished sizes before planing. Sleepers for the one and a quarter-inch maple flooring were of three by four-inch long-leaf yellow pine embedded in concrete and spaced eighteen inches centre to centre.

All mortar was made of lime and Portland cement and the windows and door sills were made of dressed blue stone.

Salmond Brothers, of Newark and Arlington, N. J., were the contractors for this work, and Wilson, Harris & Richards, of Philadelphia, were the architects for the General Electric Company.

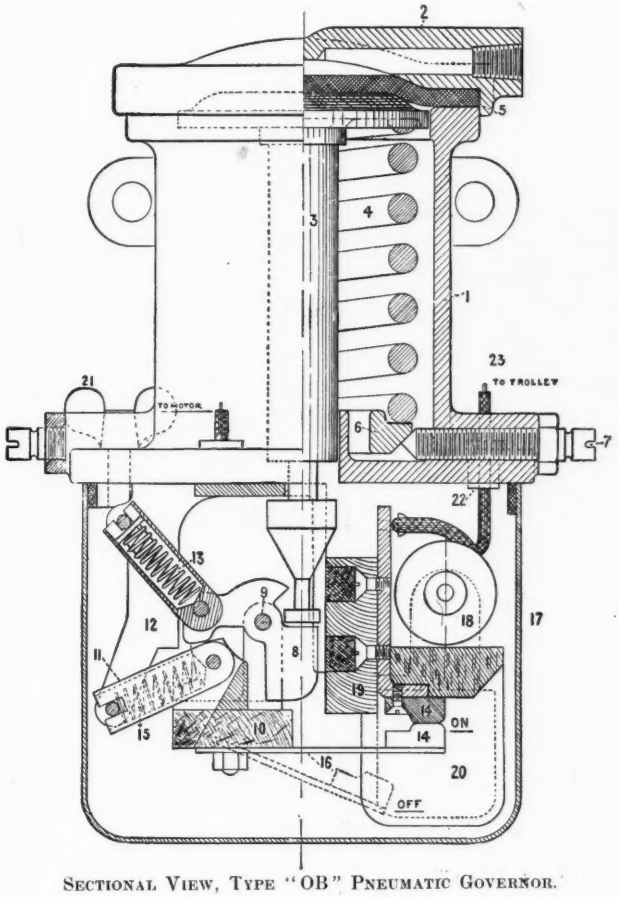
Allis-Chalmers Type "OB" Pneumatic Governor.

The reliable operation of an air-brake equipment depends largely upon the governor, which, by automatically controlling the compressor, maintains the supply of air at any pressure required. Immediately after entering upon the manufacture of complete air-brake equipments under the Christensen patents, the Allis-Chalmers Company directed its engineers to design a governor which would overcome the objectionable features experienced in earlier designs. How well it has succeeded may be shown in a reference to the first trial which this apparatus sustained outside of the company's own works.

Prior to the placing of a large order it was given an exhaustive test by the engineering department of the Manhattan Elevated Railway, New York city, in a series of 284,000 continuous operations, breaking a current of thirty-five to forty amperes, at 600 volts, without any attention whatever during the period of the test, which would be equivalent to about two and one-half years' service under ordinary conditions.

One of the chief merits of this device is the simplicity of design. There are no small ports, slides or check-valves, and it is also very positive in its operation. For example, the switch-arm, engaged by the pressure piston is held in contact by a special spring device until the instant of the quick "snap" break, and this, together with a powerful magnetic blow-out made in accordance with the latest designs, absolutely prevents sparking or burning of contacts and consequent pitting.

A sectional view of the type "OB" governor is shown herewith. The main body 1 contains a compression spring 4 and piston 3, upon which the air-pressure acts.



Sectional View, Type "OB" Pneumatic Governor.

The cap 2 is machined to receive and secure the diaphragm 5; it is bolted to the main body and tapped for pipe to connect to the main reservoir. The cap is so arranged that pipe connections may be brought from any side to the governor, which is in direct communication with the main reservoir.

The diaphragm 5 is made of pure rubber, specially prepared, insuring long life and flexibility. The piston and rod 3 are made of steel. The compression spring 4, which is enclosed within the main body and well protected against tempering, acts upon the piston. The pressure is varied by adjustment of screws 7 acting upon the spring washer 6, whereby the spring may be compressed or relieved to suit requirements. The piston-rod end is so shaped as to engage with a trip-hammer 8 and moves this over the centre position past the pivot point 9. When the pressure in the cap chamber above the diaphragm increases, the piston 3 is forced downward, compressing the spring 4.

The hammer 8 being forced by the piston rod past the dead centre, and aided by a spring 13 in housing 11, delivers a sharp blow to the yoke 9, carrying the contact blades 16, through which the circuit is opened and closed, which are made of bronze metal and well insulated against short-circuit or ground. The copper tips 14 are quickly separated, and the arc is completely extinguished by the powerful magnetic field. These contact tips are of liberal area, presenting large radiating surface. A separating shield prevents any possibility of the arc jumping across when the circuit is broken.

As the air pressure is reduced, the compressed spring 4 at once commences to return to its former position; the piston rod 3 again comes in contact with the trip-hammer 8 and reverses the movement of the latter; the yoke 9, being carried over the centre line of pivot point by the hammer, returns with a snap, aided by springs 13 and 15, and closes the circuit. This quick return is important, as it prevents arcing and gives a wiping effect to the contact tips. The yoke is firmly held in either position by the tension spring 15 and, in addition, is securely locked by the trip-hammer 8.

The quick-break mechanism is mounted upon a substantial brass frame 12 and securely fastened to the main body 1. The blow-out coil 16 and chute 20 are mounted upon an insulating block 19, which, in turn, is attached to the frame 12.

The small tension springs are protected by brass tubing, and are interchangeable without affecting the accelerating action of the mechanism.

The electric terminals 22 are brought out through the governor body and are well insulated by means of insulating bushings. They may be connected to either side of the line.

All pins and moving parts are made of hard brass, thus preventing corrosion. No lubrication to moving parts is necessary. The mechanism is protected against dust and water by a neat, light and strong cover, easily removable, which permits free access to the moving parts.

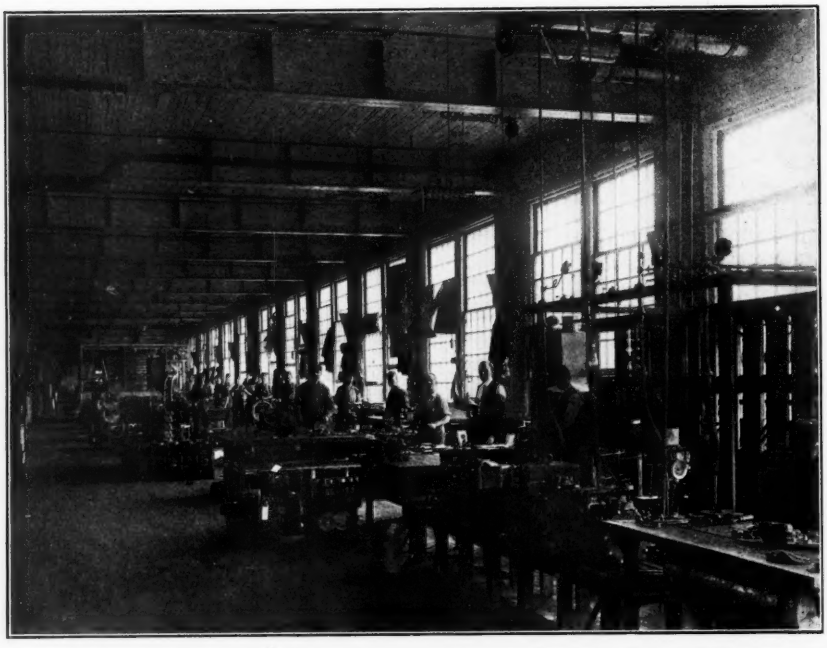
The variation of maximum and mini-

mum pressure is accomplished by the adjustment of set screws 7. The governor may be set between the pressure of sixty-five and ninety-five pounds with an operating margin of ten pounds. For example, the governor can be adjusted to cut out at eighty-five pounds pressure, and it will automatically cut in and start the compressor when the pressure drops to seventy-five pounds.

The governor will operate successfully in any position, and can be mounted below the cars or under a car seat. It occupies a space of twelve inches in height, seven inches in length and five and one-half inches in width.

The Manufacture of Christensen Air-Brakes.

The accompanying illustration shows a portion of the test floor in the air-brake department of the Allis-Chalmers Company's works at West Allis, Milwaukee, Wis., the assembling and machining of the parts being done on the same floor. This floor is 576 feet in length, and there is another floor of equal length provided for the coil-winding and armature-assembling departments. The Christensen air-brakes, which are manufactured by the Allis-Chalmers Company, are built in a shop equipped especially, comprising 69,120 square feet of floor space. Of the Christensen type air-brakes now manufactured by the Allis-Chalmers Company there are over 17,000 in daily service.



PART OF TEST FLOOR, AIR-BRAKE DEPARTMENT, ALLIS-CHALMERS WORKS, WEST ALLIS, WISCONSIN.

The orders for this equipment recently taken indicate no decline in the favor extended to this apparatus. The Consolidated Railway Company, of New Haven, Ct., whose properties are in operation in some thirty cities and towns in southern New England, recently placed an order for 280 complete air-brake equipments. As a matter of railway history it is stated that the first Christensen air-brake equipment placed in service in New England was installed in 1898 on a car of the Hartford City Railway Company, now a part of the Consolidated system. After nine years of continuous service this equipment is still in daily use.

The Interborough Rapid Transit Company, of New York city, recently placed an order with the Allis-Chalmers Company for ninety-one twenty-four-foot air-compressors and pneumatic governors.

The Christensen air-brakes are in regular service on about 350 different electrical systems throughout the world. The fact that many of these railways placed their first orders for air-brakes many years ago, and have continued to buy Christensen air-brakes, shows that these equipments have demonstrated in service features which have been appreciated by street railway operators.

A New Electrolier.

An interesting novelty in electric standards and fixtures is soon to be introduced to the trade. In this new device a certain portion of the fixture moves to a different position as the lamp lights, thus causing the electrolier to assume a different aspect according to whether the lamp is lighted or extinguished. This is accomplished by means of a solenoid or a long-pull magnet of suitable alternating-current design, which is controlled by the lamp switch so that the movement is entirely automatic, the movable member resuming its position when the lamp is turned off.

The variety of artistic effects which may be obtained by this simple action is almost without limit.

A switch is turned and the bronze figure of a sturdy yeoman, swiftly yet without shock or vibration, swings a lantern above his head where it remains until another turn brings the extinguished lantern again to his side. In this case a dash-pot is used in conjunction with the solenoid to prevent too abrupt movement, and the arm pivoted at the shoulder is moved by the shaft extending into the trunk of the figure to which the magnet core and counterweight is connected.

Another form of standard equipped with this auxiliary resembles a tasteful vase or urn. When the switch is turned the upper portion of the urn rises some three inches to form the shade of a very attractive electrolier.

A fixture has drooping petals which entirely cover the lamp. As the current is admitted the petals expand to form a shade.

In the grotesque figure of a dragon or griffin the mouth opens and a lamp protrudes as the circuit is closed while similarly the doors open, in the representation of an inn entrance, and a damsel appears with a cheerful light as the switch is turned.

Though the effort thus far has been to adapt the auxiliary to purely ornamental devices, one of the valuable features it possesses is that of protecting and concealing the lamp.

Where space is limited the fixture may be so arranged that the lamp emerges from a recess in the wall or desk as the switch is pressed and automatically recedes when turned off. The shade in this application may be so arranged that the cavity in the wall is covered as the lamp retires, leaving the surface flush.

In all cases the mechanism is made as simple as possible, and as the movable part is in all cases counterbalanced by weights or springs, the additional power required to operate is reduced to a minimum. The inventor, Ronald P. Irving, Quincy, Mass., states that patents are to be taken out on the device, which is known as the "Automaton Electrolier."

An Interesting Exhibit at the New York Electrical Show.

One of the most interesting exhibits at the recent electrical show at Madison Square Garden, New York city, was that of the India Rubber and Gutta Percha Insulating Company, a photograph of which is shown herewith. The company arranged a luxurious reception room, to which patrons and friends were cordially invited, and at which they were royally entertained. The company made a striking display of "Habirshaw" wires and cables and conductors of every description for overhead, underground and submarine work. The well-known representatives, James B. Olson, general sales manager, and R. S. Satterlee, secretary and purchasing agent, will be recognized in the photograph.

THE INDIA RUBBER AND GUTTA PERCHA INSULATING COMPANY AT THE NEW YORK ELECTRICAL SHOW.

The International Independent Telephone Association.

The annual convention of the International Independent Telephone Association will be held at the Coliseum, Chicago, Ill., January 21, 22 and 23, 1908. This date is during the period of the third annual electrical show, which will be held under the auspices of the Electrical Trades Exposition Company, January 13 to 25. Telephone manufacturers have already arranged to make a large combined exhibit of telephones and telephone apparatus, which will occupy the entire annex, containing over 10,000 square feet of floor space. This will be the largest and most complete exhibit of telephones and telephone devices ever held at any one time.

Annual Report of the Western Union Telegraph Company.

The annual report of Colonel Robert C. Clowry, president of the Western Union Telegraph Company, to the stockholders, made at their meeting, October 9, shows the following conditions:

The capital stock outstanding is unchanged, namely, $97,370,000, of which $29,394 belongs to and is in the treasury of the company.

The bonded debt at the close of the year was as follows: Funding and real estate mortgage bonds, due May 1, 1950, four and one-half per cent, $20,000,000; collateral trust bonds, due January 1, 1938, five per cent, $8,615,000; convertible redeemable bonds, due November 1, 1936, four per cent, $7,200,000; total, $35,815,000.

During the year there was issued $7,200,000 of the $25,000,000, four per cent convertible redeemable bonds, due November 1, 1936, authorized by the stockholders November 23, 1906.

The net growth of the plant was: In poles and cable 2,687 miles; in wire 65,052 miles; in offices 437.

Of the total of 1,321,199 miles of wire at the close of the year 419,450 miles were of copper and 901,749 of iron; an increase in copper of 67,286 miles and a decrease in iron of 2,234 miles during the year, due to the substitution of copper for iron.

The number of messages increased 3,317,469.

The revenues of the company increased $2,180,751.72.

The operating and general expenses increased $2,066,582.83. This increase was due to the necessary outlay to care for the larger number of messages handled, to the increase of ten per cent in the salaries of all the operators in the company's employ which went into effect March 1, 1907, and to the continued high prices for all materials used in the maintenance of the lines.

The improvements in the property of the company referred to in the last annual report were continued during the year under review, making large expenditures necessary and increasing the outlay for reconstruction of poles and wires $758,354.37.

The automatic printing telegraph owned by the company has been extended and is now applied to the business exchanged between New York city on the one hand and Buffalo, Boston, Pittsburg, Chicago, Philadelphia, Atlanta and St. Louis on the other; also to that between Chicago and St. Louis; between Philadelphia and Pittsburg and between Buffalo and Chicago.

The cost of construction was $2,872,950.53, which was $420,030.83 less than last year.

BUSINESS OF THE YEAR.

	Year ended June 30, 1906.	Year ended June 30, 1907.	Increase.	Decrease.
Revenues	$30,675,654.53	$32,856,406.25	$2,180,751.72	
Expenses, see statement below	23,605,071.65	26,532,196.20	2,927,124.55	
Net Revenue	$7,070,582.88	$6,324,210.05		$746,372.83
Interest on bonds	1,327,975.00	1,420,061.00	92,086.00	
Profits	$5,742,607.88	$4,904,149.05		$838,458.83
Appropriated for dividends	4,868,088.75	4,868,096.25	7.50	
Surplus	$874,519.13	$36,052.80		$838,466.33

Surplus July 1, 1906	$16,848,728.38
Carried to surplus as above	36,052.80
Surplus June 30, 1907	$16,884,781.18

Statement of expenses for the year:	
Operating and general expenses, including taxes	$19,257,622.30
Rental of leased lines	1,545,570.96
Maintenance and reconstruction of lines	5,278,293.36
Equipment of offices and wires	450,709.58
Total expenses as above	$26,532,196.20

Current Electrical News

DOMESTIC AND EXPORT.

PROPOSED WESTERN ELECTRIC COMPANY BOND ISSUE—Stockholders of the Western Electric Company will vote in Chicago, November 5, on the proposition to create a mortgage of $15,000,000 to secure an issue of the company's first mortgage five per cent gold bonds. The bonds will not be sold for some time. The purpose of the issue is not stated. At present the company has no bonded indebtedness. Its authorized capital is $25,000,000, of which $15,000,000 is outstanding.

ELECTRIC ROAD FOR ALASKA—Alaska is to be provided with additional railroad facilities by the construction of a narrow gauge electric road, the Alaska Home Railway, which will be operated between Valdez and Fairbanks. At the first meeting $106,000 was subscribed by residents of Valdez toward the building of this road, which will be constructed at an expense of $10,000 a mile. Since the initial meeting in Valdez, nearly $150,000 additional has been subscribed in Seattle, leaving only about $90,000 to be raised to complete the construction of a road over the mountain range back of Valdez. Six hundred men are at work, and already the wharves and terminals at Valdez are completed.

SYRACUSE TELEPHONE COMPANY TO MAKE IMPROVEMENTS—The Syracuse Independent Telephone Company is planning to spend $450,000 in extending and improving its system in Syracuse, N. Y. The plan for the reorganization of the United States Independent Telephone Company, the company which holds the stock of the Syracuse company, has been consummated. This provides for the surrendering of outstanding securities, the issuing of new securities and the assessment of a considerable sum on the new security holders to provide money for the extensions. As soon as the money is in hand the company will begin to extend its plant. Much of the money to be spent will be used in installing new telephones and new cables. Since the announcement of the new rate of $24 the Independent company has received a large number of contracts.

PENNSYLVANIA RAILROAD TO ELECTRIFY ITS TERMINALS—Beginning with the electrification of the New York terminals, the line from New York to Philadelphia, the Philadelphia terminal and the main line extending at least twenty-five miles westward from Philadelphia, the Pennsylvania Railroad is committed to the ultimate electrification of its entire system as rapidly as the improvement can be completed. This announcement is made by Pittsburg officials of the company who explain in a general way the tentative plans for the electrification of the system. The first extension of the electric system will be from New York to Philadelphia and probably twenty-five miles west of Philadelphia. After this is completed the plan calls for the complete electrification of the Pittsburg terminals, on which $23,000,000 has been spent within five years. After electrifying the Pittsburg terminals, gradual extensions will be made eastward from Pittsburg and westward from Philadelphia until the two improvements meet. Changes will be made gradually. At first only passenger trains will be operated by electricity, but this will be followed by the movement of freight by the same motive power.

ADVERSE OPINION IN REGARD TO PROPOSED MILWAUKEE LIGHT PLANT—City Attorney Kelly, of Milwaukee, Wis., is of the opinion that Milwaukee can not enter the commercial lighting field without first presenting its case to the state railway rate commission. He states in part as follows: "In view of the conditions existing as to electric lighting in the city of Milwaukee at the present time and the provisions of law applicable thereto, I am of the opinion that the city can not provide a plant to furnish electric light for private purposes, without first securing from the railroad commission of Wisconsin a declaration, after a public hearing of all parties interested, that public convenience and necessity in Milwaukee require such. When the city shall have erected, or shall have acquired an electric lighting plant in the manner provided by law, it can without doubt 'furnish and sell electric light and power to the inhabitants of Milwaukee for private purposes.' But the acquisition of an electric lighting plant by the city will be attended by some difficulty and, while your question does not go so far, I deem it prudent to advise you of the provisions of law to be observed so that your procedure may be guarded by taking in their order the necessary steps."

MEXICAN TRACTION COMBINE—A combination has been effected between two American and British syndicates for the working of extensive electric traction properties in Mexico. The American syndicate, which includes in its membership Minor C. Keith, vice-president of the United Fruit Company, is identical with the interests that control the Mexican Light and Power Company, the Monterey Railway, Light and Power Company, Mexico; the Rio de Janeiro Tramway, Light and Power Company, the Bahia Tramway, Light and Power Company, the Sao Paulo Tramway, Light and Power Company, and other Brazilian enterprises, which, together with the various West Indian projects, represent an investment of close to $150,000,000. The British syndicate is headed by Sir Weetman D. Pearson, who is head of the British contracting firm of S. Pearson & Son, Limited. The deal refers to the construction and operation of an extensive electric traction system in Puebla, the capital of the state of Puebla, and one of the leading commercial cities in Mexico. The Ferrocarril Industrial de Puebla, a mule line, connecting Puebla, Cholula and Hujotzingo, has been secured by the American syndicate, and the Ferrocarril Urbano de Puebla, another mule road, has also been taken over. These lines are about forty-five miles in length. They will be changed to electric motive power and considerably extended. The Puebla Tramway, Light and Power Company has been formed by the Americans in order to take over the properties. This company has now been merged with the Anglo-Mexican Light Company, in which Sir Weetman D. Pearson is the dominant factor. The Anglo-Mexican company owns the water-power rights in the vicinity of Puebla, and as steam is out of the question, owing to the prohibitive cost of coal—ranging from $10 to $12 a ton—water power is essential to operate the cars electrically. The amount involved in the Puebla transaction is about $15,000,000 (gold).

EXTENSIVE WORK PLANNED BY CENTRAL AND EASTERN COLORADO POWER COMPANIES—It is announced that $50,000,000 is available for the work of the Central and Eastern Colorado Power companies. Much of the preparatory work has already been undertaken. The final surveys have been completed for a dam and three power plants in Estes Park which will cost $10,000,000, and which will generate 30,000 horse-power. It is expected that work will begin soon after the first of the year. Options are said to have been secured on a power site within a short distance of Denver, which, in addition to the plants now under way, will give the company sufficient power to operate throughout the state. Control of additional power sites in the northern part of the state which will enable the generating of almost double the capacity previously announced has also been secured. A storage reservoir with a capacity of 4,000,000,000 cubic feet of water is to be built at the head of the South fork of the Thompson river. The dam will be 165 feet high and will back the water up for one mile into Estes Park. The first power plant is to be located at the foot of the dam, where a drop of 200 feet will be secured. This plant will generate 10,000 horse-power. The water will be carried from this plant down the cañon to the forks in pipes, where a similar plant with an equal capacity will be constructed. This plan will be followed to where the Handy dam is now located, where a third plant with a capacity of 10,000 horse-power will be located. After the water is used for generating this power it will be carried out to the agricul-

tural country beyond and used for irrigation purposes. The new scheme for Estes Park makes the fourth now under way by the company in addition to the operations of smaller companies controlled by the main organization. These are the Estes Park proposition, the plant now being constructed at Nederland, in Boulder Cañon, twenty miles from Denver, the Shoshone plant near Glenwood Springs, and the Gore Cañon plant on the Moffat road.

BELL COMPANY TO MERGE MINOR LINES—The corporate title of the Bell Telephone Company of Philadelphia, which will shortly be changed to the Bell Telephone Company of Pennsylvania, will be the first step looking to the welding into an integral whole of the several telephone companies in the district, which while closely affiliated and all controlled by the American Telephone and Telegraph Company, have been operated as separate concerns. To consummate this plan a special meeting of the stockholders of the Bell Telephone Company of Philadelphia has been called for December 3, when they will be asked to approve an agreement for the purchase of all the outstanding capital stock, franchises, property, etc., of the Pennsylvania Telephone Company, the Delaware & Atlantic Telegraph and Telephone Company and the Chesapeake & Potomac Telephone Company. The new corporation will constitute one of the most important members of the American Telephone and Telegraph Company. It will cover a district of more than 45,000 square miles, extending from Coatesville and Altoona, Pa., to the Delaware river and south through Maryland and the District of Columbia into West Virginia. The outstanding capital of the Bell Telephone Company of Philadelphia is approximately $25,000,000, that of the Pennsylvania Telephone Company $5,000,000 and of the Chesapeake & Potomac Telephone Company $12,000,000. This will give the new consolidated company a capitalization of $42,000,000 at its inception, as the capital of the Delaware & Atlantic company is only nominal and is owned by the Philadelphia Bell company. This capital of the new compny, however, with the approval of the shareholders, will be increased to $60,000,000, the additional $18,000,000 capital being required for improvements and extensions of the merged system. The shareholders at the December meeting will also be asked to approve amendments to the charter and by-laws, providing that the par value of the shares be increased from $50 to $100, and the number of directors be increased from twelve to fifteen.

ELECTRIC RAILWAYS.

SACRAMENTO, CAL.—The trustees have granted the Vallejo Northern electric railway a right of way through this city.

LEXINGTON, KY.—Interurban cars have begun running between this city and Frankfort. The road had been under construction for two years. It runs through Versailles.

OSHKOSH, WIS.—Plans for the reorganization of the Winnebago Traction Company are under way. It is planned to expend about $300,000 in improving and extending the lines.

NORFOLK, VA.—The Norfolk & Portsmouth Traction Company has landed its cable from the Brambleton power plant, and Portsmouth street cars are now being operated by electricity generated in Norfolk.

TROY, N. Y.—The new trolley line which is to be built between this city and Hoosick Falls next spring will follow the Boston & Maine Railroad, through Eagle Bridge, Buskirks, Johnsonville, Valley Falls, Schaghticoke, Grant's Corners and Spiegletown.

MINNEAPOLIS, MINN.—A contract for the financing of the Omaha & Nebraska Railway Company has been negotiated by the H. J. Folts Company. The railway is to be an electric line and will reach from Omaha to Hastings, Neb., a distance of 159 miles.

STAMFORD, CT.—Electric train service on the New Haven road has been extended to Stamford, the eastern limit of the electric zone. Six locals will be run at first and the service will be extended until all locals and express trains are drawn by electricity.

BALTIMORE, MD.—Fire of unknown origin did damage approximating $150,000 to the Falls Road power-house of the United Railways and Electric Company on October 5. Seven generators and five engines were destroyed. The loss is fully covered by insurance.

LOUISVILLE, KY.—The Indianapolis & Louisville Traction Company has filed a mortgage in favor of the Colonial Trust Company, of Pittsburg, and F. F. Brooks, as trustees, to secure $400,000 mortgage and collateral trust 6 per cent five-year convertible gold notes

BEAVER, PA.—The Ira W. Logan Company, of Rochester, has been awarded the contract for laying the rails for the new street railway for the Jones & Laughlin Company, which bought the franchise of the Monaca & Ambridge Street Railway Company some time ago.

BEMIDJI, MINN.—At a regular meeting of the city council the ordinance granting to Carl C. Gowran, A. A. Carter and George W. Teitsworth the privilege of constructing and maintaining a street railway within the limits of Bemidji for a period of twenty-five years was passed by unanimous vote of the council.

MANSFIELD, OHIO—At a meeting of the board of directors of the Mansfield Railway, Light and Power Company, F. L. Fuller and J. Southerden, of Cleveland, and Sidney Foltz resigned as directors and E. T. Pomeroy and J. O. Rutherford, of Cleveland, and F. E. Myers, of Ashland, were elected to fill the vacancies.

GREENCASTLE, PA.—At a meeting of the Greencastle town council a franchise was granted to the Chambersburg, Greencastle & Waynesboro Street Railway Company to operate its line through that town. The ordinance does not require any tax on poles, cars or other parts of the line. The company has also been granted a franchise in Chambersburg.

GUTHRIE, OKLA.—A territorial charter has been granted to the Oklahoma Electric Terminal Company, of Oklahoma City, with $2,500,000 capital stock, to build twelve miles of terminal railway in Oklahoma City, at an estimated cost of $5,000,000. The incorporators include Guy V. McClure, Charles Combs, Warren E. Moore, J. J. Johnson and Fred S. Combs.

LEXINGTON, KY.—Work will soon begin on the power-house of the Lexington & Interurban Railways Company, to be erected at Valley View. This power plant, which will cost between $400,000 and $500,000 when completed, will be the largest in Kentucky and will furnish power for the Lexington street railway as well as all the traction lines extending out of Lexington.

GREENVILLE, TEX.—Capitalists of Greenville, Bonham and Wolfe City have taken steps toward organizing to build and operate an electric car line from this city to Bonham by way of Wolfe City. In addition to building the interurban from Greenville to Bonham it is intended to build and operate modern up-to-date local electric street-car systems in Bonham, Wolfe City and Greenville.

JACKSON, MICH.—It is stated that the electric railway between Ludington and Grand Rapids, Mich., will be completed within a year. The promoters state that eighty per cent of the right of way has been obtained and that eastern capitalists are ready to furnish $285,000 as soon as the farmers along the road subscribe $15,000. Several miles of the road have already been graded between Ludington and Pentwater.

SOUTH BEND, IND.—Arrangements have been completed by the promoters of the Fort Wayne & South Bend Railway by which work will be started in the near future. Since President Perry A. Randall, of Fort Wayne, has arranged for the American Trust Company, of Indianapolis, to act as trustee for the bondholders of an issue of $2,000,000 in six per cent gold bonds, several hundred thousand dollars of the stock has been subscribed for by a Chicago syndicate.

YORK, PA.—A state trolley line, which will extend from Sunbury to Selins Grove, a distance of about eight miles, at which will be established a summer park, will be built by the York Construction Company. The contract price is $247,000. This is to cover the entire cost of building and the cost of equipment. The new trolley line will connect rich sections of Snyder and Northumberland counties and will especially develop the agricultural section of Snyder county.

OLYMPIA, WASH.—Two new railroad companies have filed articles of incorporation. The Pullman, La Crosse & Columbia Railroad is capitalized at $1,500,000, the announced purpose being to build and operate a steam, electric or motor road from Pullman *via* La Crosse to some point yet to be selected on the Columbia river. The incorporators are: J. O. Staats, H. M. Greene, J. H. Clarke, T. H. Shobe, E. S. Knowlton and J. S. Shrock, all of La Crosse, and J. B. Taggart, of Hay, Wash. The Seattle Southern Company,

capitalized at $500,000, is incorporated by Julius F. Hale and Morris B. Sachs. No route is stated.

PITTSBURG, PA.—A party of eastern capitalists, supposed to represent the Lackawanna Steel Company, has closed a deal for the rights of way of the proposed Monongahela, Ellsworth & Washington street railway. The traction company was organized two years ago, but has not progressed further than to secure rights of way. The deal has been put through with the understanding that work on the road is to start at once. Within two years Washington and Monongahela will be connected by trolley.

DANVILLE, IND.—The Indianapolis & Danville traction line is to be extended to Amo, seven miles southwest, to connect with the Terre Haute, Indianapolis & Eastern, which will give it through connections both east and west. From Amo a new line will be built south to Martinsville, connecting with the Indianapolis and Martinsville line, which will give the traction syndicate a line west and south of Indianapolis, connecting the large and populous counties of Marion, Hendricks and Morgan. The work is to begin at once.

SPRINGFIELD, ILL.—At a meeting of the board of directors of the St. Louis, Terre Haute & Quincy Traction Company eight out of the nine directors were present. L. J. Pulliam, of Springfield, Ill., and C. W. Payne, of Roodhouse, Ill., tendered their resignations as directors of the company, which were accepted. M. H. Ewer, of Decatur, Ill., and I. E. Ewer, of Memphis, Tenn , were elected directors, to fill the vacancies. The secretary, E. E. Barclay, also tendered his resignation, which was accepted. The office of secretary was left vacant.

MOORHEAD, MINN.—The board of directors of the Northwestern Interurban Electric Railway Company has elected the following officers: Thomas T. Bubb, president and chief engineer; James J. Lambrecht, vice-president; E. Y. Wheeler, treasurer; Samuel F. Crabbe, consulting engineer, and Thomas R. Brown, secretary. It is understood that the new interurban line will be contracted for in sections. The company will fully equip and complete one section before starting on a new one. A board of audit will have control over the expenditure of funds. The general offices will be in this city.

NEWTOWN, PA.—The Newtown, Langhorne & Bristol Trolley Street Railway Company has disbanded as a corporation. All the directors resigned and the affairs were turned over to the new organization. The new company immediately organized as follows: president, Frank Battles; vice-president, W. Frederick Snyder; treasurer, H. H. Harrison; secretary and assistant treasurer, John L. Richter; general manager, W. H. Janney; board of directors, Frank Battles, W. Frederick Snyder, H. H. Harrison, William Henry Snyder, A. D. Chapin, Jr., and Alexander Chambers. Battles, Heye & Harrison are the new owners.

NEW YORK, N. Y.—The appellate division of the Supreme Court in Brooklyn has handed down a decision in which it holds that the South Shore Traction Company has lost its franchise to construct a trolley road to Islip, Suffolk county. The road is now under construction. It was proposed to operate a trolley line through Patchogue, Islip, Bay Shore, Babylon, Amityville, Freeport, Lynbrook, Jamaica, Newtown, Long Island City and the Blackwell's Island bridge. It was intimated that large Pittsburg interests were behind the proposed trolley road. It was contended that the company had lost its right to use the franchise because it failed to construct the road within the time limit stated in the franchise.

PHILADELPHIA, PA.—George W. Goddard is back of a plan to construct a subway under North Broad street, Philadelphia, at a cost of $10,000,000. Some weeks ago Mr. Goddard, who is manager of the Trolley Electric Vehicle Company; Montgomery Harris, an insurance broker, and Charles Willing took out a charter at Harrisburg for the Philadelphia Subway Terminal Railway Company. This company has an authorized capital of $40,000. It has no franchise to construct and operate an electric subway under Broad street from Filbert street north to near Clearfield street, as is proposed. Under the contract between the city and the Philadelphia Rapid Transit Company, the latter would have the refusal on any such franchise.

WATERLOO, IOWA—The Waterloo, Pella & Southwestern plans to build a line southwesterly from Waterloo through Traer, Toledo, Tama, Sheridan, Grinnell, Sully, Pella, Howell, Durham, Attica, Columbia and Olmitz to Chariton. An effort is being made to interest business men and capitalists along the route in the project. The proposed line is about 120 miles long. The promoters claim that the road will tap an undeveloped coal field. They also claim that the territory it taps is one of the best farming and freight producing sections of the state. In addition to the towns named above, eight or more new stations will be established. The road will also connect eight trunk lines and make a short haul for the transfer of business.

CENTRALIA, WASH.—B. J. Weeks, of Tacoma, who has resigned his position as general manager of the Pacific Traction Company, is to promote and build a new electric line, to be known as the Centralia, Chehalis & Western Railway Company. The company will build eight miles of road between Centralia and Chehalis and a two-mile branch to connect with a freight centre. It is stated that $150,000 worth of bonds for the new line has already been subscribed and that numerous good freight contracts are offered, guaranteeing the new line an excellent business. F. B. Hubbard, of the Eastern & Western Railway and Lumber Company, is to be president of the new company, and many of the stockholders are said to be the same as those of the Pacific Traction Company, of Tacoma, which leads to the belief that the two lines will eventually connect, giving a through electric road from Tacoma.

NEW MANUFACTURING COMPANIES.

NEW YORK, N. Y.—The Illumination Improvement Company has been incorporated to manufacture gas and electrical appliances. The capital stock is $25,000, and the incorporators are: T. Morch, H. G. Bailey, H. C. Fuller, New York city.

RIVERSIDE, CAL.—The Riverside Fixture Company, an electrical concern, has been incorporated with a capital of $25,000, of which $4,000 is paid up. D. A. Bender of San Rafael, R. W. Bender and J. F. Butler are the incorporators.

AUSTIN, TEX.—A charter for the Anderson-Lacy Electric Headlight Company, of Houston, has been filed. The incorporators are: H. T. D. Wilson, T. J. Anderson and B. B. Lacy. The capital stock is $10,000 and the purpose is to manufacture electric headlights.

ALBANY, N. Y.—The George H. Rice Company, of Brooklyn, has been incorporated with the secretary of state, to deal in electrical machinery, advertising signs, etc., and to carry on the business of electrical engineers. The capital stock is $40,000, and the directors are as follows: George H. Rice, John J. Halshul, and Thomas M. Harvey, of Brooklyn.

COLUMBUS, OHIO—Papers have been filed in the office of the secretary of state at Columbus for the incorporation of the Solar Glass Company, with a capital stock of $50,000. The incorporators, all of whom are local people, are E. A. Hudson, Bert J. Long, J. J. McMullin, E. G. Hammond and Wilson W. James. The company is organized for the purpose of manufacturing glassware of all kinds for electrical purposes.

TELEPHONE AND TELEGRAPH.

BATAVIA, N. Y.—The Bell Telephone Company will erect a new exchange, which, with the necessary equipment, will cost $50,000.

FAIRBANKS, ALASKA—The Fairbanks Telephone Company is considering the construction of a long-distance line from Fairbanks to Valdez.

DECATUR, NEB.—Dr. J. W. Collins, president of the Home Telephone Company, has signed a contract for the installation of an automatic exchange. The cost will be $100,000.

SAN FRANCISCO, CAL.—The Pacific Telephone and Telegraph Company had on September 1 a total of 277,687 subscribers' stations. This compares with 248,360 stations on January 1, an increase of 29,337 stations, or 11.8 per cent.

LOUISVILLE, KY.—For the purpose of taking over a number of telephone properties in eastern Kentucky, the Southern Bell Telephone Company of Kentucky has been incorporated. The capital stock of the new company is $100,000, divided into 1,000 shares of $100 each. The incorporators are: Hunt Chipley, secretary; S. B. Naff, treasurer, both of Atlanta, Ga.; W. T. Williamson, president, Charlestown, W. Va., and W. L. and John C. Doolan, vice-presidents, both of Louisville.

PERSONAL MENTION.

MR. S. S. NEFF, superintendent of the Atlantic City & Shore Railroad, Atlantic City, N. J., has been appointed manager of the new company which has merged the fast shore line and the Atlantic avenue line.

MR. WALTER B. SNOW, for nearly twenty-five years publicity manager for the B. F. Sturtevant Company, has established an office at 170 Summer street, Boston, Mass., for the production of publicity for manufacturers of machinery and allied products. This will include general advertising, catalogue making, technical writing and investigation.

MR. CHARLES A. BROWN, patent attorney, Monadnock Block, Chicago, Ill., announces a partnership with Lynn A. Williams (for six years past his assistant), for the practice of patent law under the firm name of Brown & Williams. Mr. A. C. Bell, who has been in charge of the patent department of the Stromberg-Carlson Telephone Manufacturing Company, has taken a position with this firm and will give attention chiefly to the work of patent soliciting. Mr. Bell is a graduate of Cornell University, and has had practical experience as a mechanical and electrical engineer in addition to several years' work in soliciting patents.

MR. EDWARD E. POTTER, general superintendent of the Union Street Railway Company and the Dartmouth & Westport Street Railway Company, New Bedford, Mass., has been granted an indefinite leave of absence, and will go to Seattle, Wash. Treasurer Elton S. Wilde has been appointed acting superintendent of both roads, and Edward F. Nicholson, who is in charge of the electric express department, will be assistant treasurer, while Charles T. Battey will take the position of acting manager of the electric express. Fred W. Lurs, formerly in the electric express office at New Bedford, will re-enter the employ of the company to take Mr. Battey's place in Fall River.

NEW INCORPORATIONS.

NASHVILLE, TENN.—Rock City Electric Company. $10,000. Incorporators: John A. Bell, Louis Leftwich, Hamilton Parks, William L. Talley and M. A. Montgomery.

INDIANAPOLIS, IND.—The Coatesville Telephone Exchange Company, Coatesville. $1,500. Stockholders: Jesse Masten, H. T. Bohannon, S. Hunt, C. S. Hessler, G. W. Hunter, D. S. Bowen and F. E. Todd.

INDIANAPOLIS, IND.—Evansville, Petersburg & Vincennes Railroad Company, Evansville. $10,000. Directors: F. W. Cook, T. M. Honeywell, John M. Funk, Louis J. Herman and H. E. Meyer. To build an electric line from Evansville to Petersburg.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

American Electrochemical Society. Fall meeting, New York city, October 17-19.

Western Association of Electrical Inspectors. St. Paul, Minn., October 22-24.

American Association for the Advancement of Science. Chicago, Ill., December.

ELECTRICAL SECURITIES.

Genuinely demoralized dealings marked some of the sessions of last week's market. General declines were scored and new low price records were made, some of these being lower than for several years. The general average of prices touched a new low point for the year. A good deal of the selling was of a forced character, and a very unfavorable tone was given to the market by the unloading of a considerable number of shares from foreign holders, particularly from Holland. The unsettling disclosures which have come to light, due to investigations by public service commissions in various parts of the country, have, of course, had much to do with the lack of confidence on the part of the buying public and the inability of professional investors to make good upon their buying, owing to the lack of public support. The necessity of returning large amounts of money to the interior, and the excessive calls made upon our exchequer through foreign holdings have caused a considerable tightening in the money market, and with this firmness has come also the inability of prospective borrowers to figure out meeting the interest asked for, due to the depreciated values of the investments involved. It is evident, however, that there will be constantly a need for a considerable expenditure in all classes of industry, due to the necessity for keeping up the present facilities of manufacture. Present orders from railroads alone for ordinary maintenance are great enough to maintain workshops and factories which would, a few years ago have been capable of stocking the market with available material. New orders appear to have fallen off about twenty per cent. How long this condition will continue is a matter which the near future will probably decide. It is a fact, however, that the industrial retrogression is not viewed with particular apprehension, as financial and manufacturing interests are one in the belief that the only way that the country can be restored to equilibrium is by the loosening up of the immense amounts of capital which have been stored away due to the last three years' development, which many people now believe should have been spread over at least a decade.

Dividends have been declared upon the following electrical securities: Milwaukee Electric Railway and Light Company; quarterly dividend of 1½ per cent on the preferred stock, payable October 31. Mexican Telephone and Telegraph Company; regular semi-annual dividend of 2½ per cent, payable November 1 to stockholders of record October 15. United Electric Securities Company; regular semi-annual dividend of $3.50 on the preferred stock, payable November 1 to stockholders of record October 22. Electric Bond and Share Company; regular quarterly dividend of 1¼ per cent on the preferred stock, payable November 1 to stockholders of record October 16. Columbus, Ohio, Railway Company; quarterly dividend of 1¼ per cent on the preferred stock, payable November 1 to stockholders of record October 15. Montreal Street Railway Company; regular quarterly dividend of 2½ per cent, payable November 1. Dartmouth & Westport Street Railway Company; quarterly dividend of 2 per cent, payable October 15. Michigan State Telephone Company; regular quarterly dividend of 1½ per cent on the preferred stock, payable November 1. Auburn & Syracuse Electric Railroad Company; quarterly dividend of 1½ per cent on the preferred stock, payable October 15. Lincoln (Neb.) Traction Company; dividend of 4 per cent on the common stock, payable October 15. Spokane & Inland Empire Railroad Company; regular quarterly dividend of 1¼ per cent on the preferred trust certificates, payable October 20. Central District and Printing Telegraph Company; regular quarterly dividend of 2 per cent, payable October 31 to stockholders of record October 24. Twin City Rapid Transit Company; regular quarterly dividend of 1¼ per cent on the common stock.

ELECTRICAL SECURITIES FOR THE WEEK ENDING OCTOBER 12.

New York:	*Closing.*
Allis-Chalmers common	6
Allis-Chalmers preferred	15½
Brooklyn Rapid Transit	40¼
Consolidated Gas	91
General Electric	113½
Interborough-Metropolitan common	8⅛
Interborough-Metropolitan preferred	22¼
Kings County Electric	109
Mackay Companies (Postal Telegraph and Cables) common	58
Mackay Companies (Postal Telegraph and Cables) preferred	58½
Manhattan Elevated	115
Metropolitan Street Railway	34
New York & New Jersey Telephone	99
Western Union	67
Westinghouse Manufacturing Company	110

Boston:	*Closing.*
American Telephone and Telegraph	101
Edison Electric Illuminating	200
Massachusetts Electric	40
New England Telephone	—
Western Telephone and Telegraph preferred.	—

Philadelphia:	*Closing.*
Electric Company of America	8⅝
Electric Storage Battery common	38½
Electric Storage Battery preferred	38½
Philadelphia Electric	7¼
Philadelphia Rapid Transit	18
United Gas Improvement	76¼

Chicago:	*Closing.*
Chicago Telephone	107
Chicago Edison Light	137½
Metropolitan Elevated preferred	62
National Carbon common	70
National Carbon preferred	118

ELECTRIC LIGHTING.

CORNING, N. Y.—The streets of the village of Gibson are to be lighted electrically.

POINT PLEASANT, N. J.—The electric light plant and waterworks system were destroyed by fire on October 8.

SPOKANE, WASH.—The board of county commissioners has granted to A. M. Wood and R. H. Long a franchise for an electric lighting system in Deer Park.

ELGIN, ILL.—Fred E. Rispin and former City Electrician Fish, of Elgin, have submitted a plan to the Marengo city council to take over the municipal electric light plant.

MEMPHIS, MO.—Scott & Sons have the contract to erect the Gorin electric light plant. The structure will be built of cement blocks and will be one story high and eighteen by twenty-eight feet.

KANSAS CITY, MO.—The city council of Independence has ordered B. F. Wallace, superintendent of the municipal electric light plant, to extend the service to Maywood and Bristol on the electric line to Kansas City.

CINCINNATI, OHIO—The Dayton Citizens' Electric Company has given a mortgage to secure $1,500,000 of bonds. The Cincinnati Trust Company is the trustee under the deed of trust. The property has been in operation since last April.

BROWNSVILLE, TEX.—At a meeting of the city council the bonds for the construction of an electric lighting plant and waterworks system were sold to the Brownsville National Bank. Fifty-three thousand dollars' worth were placed on the market, the bid being par.

WASHINGTON, IND.—By a vote of 329 to 44 a scheme for remodeling the municipal lighting plant has been rejected, notwithstanding the alternative presented by the common council of providing for extensive repairs or eventually abandoning the business of municipal lighting.

WATERTOWN, WIS.—The Escanaba Electric Power and Pulp Company, capitalized at $500,000 with Watertown capital, has been granted the right by the city of Escanaba to furnish the city plant with power for lighting the streets and commercial light and power for a period of ten years.

NORTHFIELD, MINN.—A franchise has been granted the Northfield Light, Heat and Power Company. It is to run for a term of twenty years. Under the new charter no exclusive franchise may be voted a company or corporation, and the city has the right to buy the plant at any time within five years.

MILLERTON, N. Y.—The Millerton Electric Light, Heat and Power Company has been formed with a capital of $7,500. The organizers are J. Henry Roosbach and H. E. Lyle, of Canaan, Ct., and Daniel W. Gleason, of Millerton. The company will install an electric light plant, and will also operate an electric railroad.

HARTSELLE, ALA.—The Hartselle Electric Light and Power Company has been incorporated by the business men of the town, and $4,000 has already been paid in to the capital stock. J. C. Rogers, an electrician of Hartselle, is managing the company, and it is estimated that the plant will be in operation within eighty days.

DENVER, COL.—The Central Colorado Power Company has placed its engineering corps on surveys to locate a route into Denver, and it is stated by Henry Hine, general manager of the company, that the company will have its line into this city by the first of June. The power plant is now under construction at Glenwood Springs.

ST. PETER, MINN.—As a part of their plan to improve St. Peter's electric lighting service, the members of the city council have ordered extensive repairs on the pole line. They will spend several hundred dollars in this manner, and then purpose purchasing new machinery for the plant and furnishing electrical current to local manufacturing concerns.

TOLEDO, OHIO—The council has granted Homer T. Yaryan's heat and power company a twenty-five-year franchise. The action by council followed advice from the city solicitor that there was no way for a popular vote on the franchise at the present time. The company pledges itself to spend $300,000 in Toledo, one-third of which goes into an East Toledo plant. Public buildings are to be heated at one-half regular cost.

SAN FRANCISCO, CAL.—The Haight and Ashbury Improvement Club has arranged to expend $3,000 in installing a lighting system in the section of the city in which the club is interested. The merchants in the community have volunteered to contribute half the sum required and property owners have offered the balance, of which part $700 has already been received in cash.

COLUMBUS, GA.—The city council called off the election ordered for October 10 on the issuance of $100,000 of bonds for the building of a municipal lighting plant. It was decided to first make an appeal to the Georgia railroad commission. In case the lighting rates are not reduced by the commission it is probable that the ordinance ordering the bond election will be reintroduced.

ABERDEEN, S. D.—C. F. Freehauf, of Cresco, Iowa, who was granted a franchise covering the construction of a $100,000 plant and its operation for a period of twenty-five years, has written to decline the franchise on the ground that the provisions are too drastic. In the meantime there is a movement on foot to organize a local company of capitalists to carry out this much-needed improvement. The city has decided against a municipal plant.

CHICO, CAL.—L. D. Macy, proprietor of two local hotels, states that he will apply for a franchise to construct and operate an electric lighting plant in opposition to the present company. He announces that he has considerable capital of his own and others to invest in the project, and if the board grants his request, he will begin work immediately. Macy also owns water rights near West Branch, on Little Chico Creek, and will erect a power plant at this point.

CLIFTON SPRINGS, N. Y.—Ford S. Burgett, who owns the mill and water power on the Canandaigua Lake outlet, near this village, is considering the question of organizing a company to develop the power and make a bid for lighting the streets of Newark when bids are asked for again. There is sufficient power at all times to light a town four or five times as large as Newark. Mr. Burgett has specifications for a full equipment of machinery necessary to furnish electricity.

SALISBURY, N. C.—It has been announced that the Whitney Reduction Company, owner of the great water and electric power plant at the narrows on the Yadkin river, thirty miles from this city, will make Salisbury the distributing station for North Carolina. It is also stated that the company will have its main offices in Salisbury, and that its interests will be greatly increased in this part of the state. The officers of the company state that power will be ready for general use July 1, 1908. The plant has a capacity of 45,000 horse-power.

SODUS, N. Y.—The Sodus Gas and Electric Light Company has been granted a franchise by the town of Webster. Webster will be the western end of a rural system, which will include a number of villages between Sodus Point and West Webster, and many farmers between those points. The company will build thirty-five miles of line. The company's franchises have been filed with the Public Utilities Commission and the extension of the lines of the local company will be started within a short time, going first to Williamson and then westward. The company has closed the plant it has been running in Sodus for over two years, and is securing power from the Rochester Railway and Light Company.

EUGENE, ORE.—T. G. Hendricks, president of the First National Bank of Eugene, and F. L. Chambers, president of the Chambers-Bristow Banking Company, will soon begin the work of constructing an immense dam across McKenzie river, and a canal one-fourth of a mile long seven miles northeast of Eugene, for the purpose of generating power for an electric plant which they intend erecting on the site. The dam will be located just above the Hayden rapids, where there is a fall in the river of twenty or thirty feet in a distance of a few hundred yards. They have filed a notice of appropriation of 100,000 miners' inches of the water of the river, which is equivalent to a continuous flow of 2,500 cubic feet per second. The proposed canal will be fifty feet wide and twenty feet deep. It will have to be blasted out of the solid rock for a good part of the distance, the rock taken out to be used in the construction of the dam.

INDUSTRIAL ITEMS.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, will be pleased to send new literature devoted to "J-M" cross-overs and section insulators.

THE BLAKE SIGNAL AND MANUFACTURING COMPANY, 246 Summer street, Boston, Mass., has published a pamphlet entitled "The Requirements for Efficient Telephone Train Dispatching." This will be sent to any one interested upon request.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has ready for distribution bulletins No. 4,530, 4,533 and 4,534 describing and illustrating, respectively, mercury-arc rectifiers, Wright demand indicators and Curtis steam turbines of the horizontal-shaft type.

THE SPRAGUE ELECTRIC COMPANY, New York city, is sending out a new and revised edition of its conduit bulletin No. 421, which describes the Greenfield flexible steel conduit, flexible steel-armored conductors and steel-armored flexible cord. The bulletin also includes outlet boxes, fittings and tools.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., which several months ago announced the purchase of the Wirt Electric Company, of Philadelphia, now advises that it has consolidated the Wirt business with that of its New York city plant at Park avenue and 130th street, where the manufacture of Wirt apparatus will be continued.

THE NILES-BEMENT-POND COMPANY, New York city, has issued a handsome catalogue devoted to the Pond rigid turret lathe. This machine is designed for producing work ordinarily done on engine lathes, and is especially adapted to such work as gear blanks, flywheels and gas-engine cylinders. It can also be used for heavy bar work, such as wrist pins, projectiles and similar work.

THE M. W. DUNTON COMPANY, 65 Atlantic avenue, Providence, R. I., manufacturer of "Nokorode" soldering paste, announces that this paste is not only the most carefully prepared on the market, but it is put up in an especially attractive form. The standard package quantities of thirty-six two-ounce and six one-pound cans are within the reach of all. The company will send a free sample to any one who asks for it.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., reports very large sales on Stanley G-I arc lamps for which it is the agent. The company claims for the new type "K" lamp that it is the simplest arc lamp on the market and that no matter what the conditions, current or circuit it can furnish a type "K" lamp which will give good light and do it economically. The company is sending out to its trade special bulletins on this lamp.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, Hartford, Ct., has issued a handsome bulletin which was distributed at the street railway convention, Atlantic City, N. J., October 14-18. This calls particular attention to the "Novi" and "Femco" lamps. The "Novi" lamp has a special stem which supports the filament, so that it is proof against the vibration and jar which obtain in railway work. The slogan of the Franklin Electric Manufacturing Company in regard to the "Novi" lamp is as follows: "You can't shake the life out of this lamp."

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., in the October issue of "Graphite," published in the interest of Dixon's graphite products, calls attention to Dixon's graphite brushes. These are composed largely of graphite, and are therefore a lubricating agent which keeps the commutator in a well-rounded and highly polished condition. A letter from H. T. Plumb, associate professor of electrical engineering, Purdue University, highly commends the service of the Dixon graphite brush on a ten-kilowatt exciter at the university.

THE STEEL CITY ELECTRIC COMPANY, Pittsburg, Pa., announces through its manager, J. M. G. Fullman, that it has purchased the outlet box business of the Sarco Company, of New York, including patent rights, tools, machinery and stock of goods, and is now in a position to take care of orders promptly. The Steel City Electric Company already manufactures Fullman conduit bushings, Fullman lock nuts, Fullman patent floor outlet boxes and electrical and mechanical specialties.

DOSSERT & COMPANY, New York city, announces that up to date the New York Central & Hudson River Railroad has used over 1,000 straight two-way solderless connectors of all sizes up to 1,000,000 circular mils, and a larger number of cable taps in sizes from 350,000 circular mils up to 1,350,000 circular mils. These cable taps were used principally in tapping off from the third rail in series of three to connect by way of the structure to the overhead cables. The company has also made for the New York Central an emergency jumper clamp connector. In case of a break in the third rail this is attached to the third rail on each side of the break, thus preventing a tie-up of the service until the regular flow of current is reestablished.

THE AMERICAN CONDUIT COMPANY, Chicago, Ill., manufacturer of bituminized fibre conduit, has published in booklet form valuable data with regard to underground conduit construction. This book may be used to considerable advantage by central stations, particularly by those who are contemplating the establishment of subway systems. Among other features of great practical utility, there are given several curves, showing respectively, the cost of cement per cubic yard of concrete, the cost of stone per cubic yard of concrete, the cost of sand per cubic yard of concrete, the cost of labor per cubic yard of concrete, and the cost of grout mortar. This book may be had by application to any of the company's offices. A. J. McClure is the eastern representative, at 140 Nassau street, New York city.

THE STUART-HOWLAND COMPANY, 261-281 Devonshire street, Boston, Mass., has published its catalogue of electrical supplies for 1907. The extraordinary success of this company's first general supply catalogue alphabetically arranged throughout has prompted the company to issue a 1907 catalogue in the same form. The company believes that the edition will be found to be a very decided improvement. The volume is issued with a view to supplying a single handy book of reference in which the purchasing departments of electrical supply, construction and telephone companies, central stations and railways may quickly find listed, and in most cases illustrated, practically everything required in their business. The book contains 784 pages of closely printed matter; the illustrations are uniform in style and size, and altogether this is one of the finest catalogues we have ever seen.

THE WIRE AND TELEPHONE COMPANY OF AMERICA, Rome, N. Y., announces that the demand for its products in the South is such as has made necessary the opening of an office to take care of it. The Besco Supply Company, Birmingham, Ala., has been appointed agent, and a stock of bare, rubber-covered wire, magnet wire and annunciator wire, and telephone apparatus will be kept there so as to take care of orders for immediate delivery. The Wire and Telephone Company of America has recently started up its new bare-wire mill and the extension to its old insulating mill and telephone plants. The additional equipment gives this company a very large capacity for all kinds of bare and insulated copper wire and telephone apparatus. Stocks are maintained at the headquarters of the company in Rome, N. Y., and with its agents, the Commercial Electric Supply Company, St. Louis, Mo., F. W. Pardee, Chicago, Ill., H. I. Wood Electric Company, Louisville, Ky., and the Besco Supply Company, Birmingham, Ala.

Record of Electrical Patents.

Week of October 8.

867,564. ADVERTISING AND ILLUMINATING DEVICE. James E. Auclair, St. Marys, Pa., assignor to Novelty Incandescent Lamp Company, St. Marys, Pa. A transparent globe for enclosing a lamp.

867,579. ELECTRICAL CONDENSER. Léon Gerard, Brussels, Belgium, assignor to Percy Thompson, East Orange, N. J. An annular condenser, the successive surfaces having a gradually increasing width at the ends.

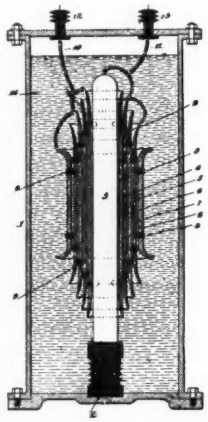
867,624. SWITCH-BOX. Harry J. Warthen, Washington, D. C. A wall box.

867,627. INDUCTION-COIL APPARATUS. Ernest C. Wilcox, Meriden, Ct., assignor to the Connecticut Telephone and Electric Company. A coil for an ignition system.

867,635. ELECTRIC SIGN. William A. F. Becker, Chicago, Ill. The letters are removable.

867,658. PROCESS OF MAKING ELECTRIC CONDUCTORS. William Hoopes, Pittsburg, Pa., and Norman A. Robertson, New York, N. Y. Aluminum while plastic, is expressed so as to envelop a stronger metal core.

867,659. ELECTRIC CONDUCTOR. William Hoopes, Pittsburg, Pa., and Norman A. Robertson, New York, N. Y. A conductor of aluminum reinforced by a core of stronger metal.



867,579.—ELECTRICAL CONDENSER.

867,707. COIN-COLLECTOR. Edward B. Craft, Wilmette, Ill., assignor to Western Electric Company, Chicago, Ill. A collector for telephone systems.

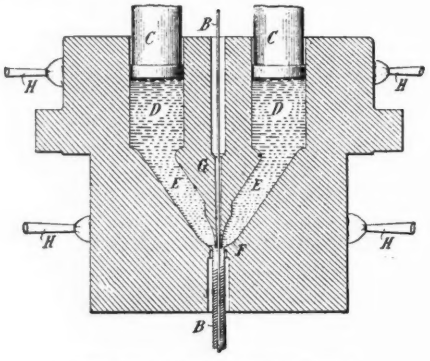
867,743. PLUG-IN SWITCH. Henry D. Murdock, New York, N. Y. A switch-box with a lid having a neck.

867,744. MAGNETIC SEPARATOR. James B. McCabe, Buffalo, N. Y. A drum having magnets on both the inner and outer surface.

867,746. COIN-COLLECTOR. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company, Chicago, Ill. A coin-actuated toll-indicating mechanism.

867,758. ELECTRIC STOP-MOTION. Frank A. Sandford, Adams, Mass. A stop-motion for looms.

867,809. SERIES-PARALLEL CONTROLLER. Arthur C. Eastwood, Cleveland, Ohio. The resistance is divided into parts and means provided for short-circuiting these parts while the motors are connected in series.



867,659.—ELECTRIC CONDUCTOR.

867,810. AUTOMATIC ACCELERATING-CONTROLLER. Arthur C. Eastwood, Cleveland, Ohio. The switches controlling the resistance steps are themselves controlled by a relay.

867,846. THERMOELECTRIC CONTROLLING MECHANISM. Harrie C. Smith, New York, N. Y. A motor-driven gear controlled by a thermostat.

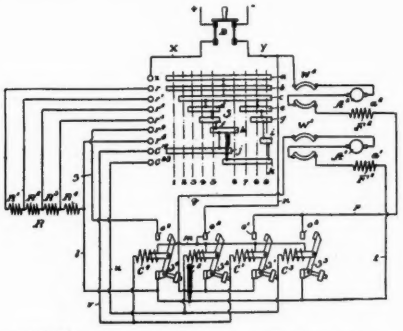
867,858. ELECTROLIER-HANGER. Robert T. Watt, Laurel Springs, N. J., assignor of one-half to Walter I. Raymond, Collingswood, N. J. The chandelier tube is supported from a ceiling plate.

867,863. ELECTRIC WATER-HEATER. Mendal W. Willson, St. Louis, Mo., assignor of one-third to James R. Walker and one-third to Lewis P. Leathers, St. Louis, Mo. A heater having an electrode comprising a metal rod with a detachable jacket of carbon.

867,876. OSCILLATION-RESPONSIVE DEVICE. Lee de Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. A sensitive conducting gaseous medium enclosed within a receptacle.

867,877. ART OF DETECTING OSCILLATIONS. Lee de Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. An electric circuit is established through a gaseous medium.

867,878. OSCILLATION-DETECTOR. Lee de Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. A device responsive to electric oscillations consisting of a Bunsen burner and an electrode in the flame.



867,809.—SERIES-PARALLEL CONTROLLER.

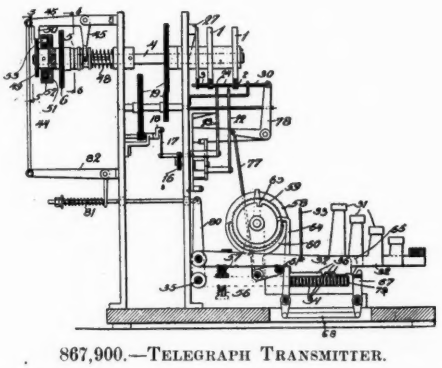
867,892. TELEPHONE SYSTEM. Frank E. Mayberry, Medford, Mass., assignor to Boston Telephone Selector Company, Boston, Mass. A central energy system.

867,895. WIRELESS TRANSMISSION OF SONOROUS VIBRATIONS. Henry A. McCarty, San Francisco, Cal., administrator of Francis Joseph McCarty, deceased, assignor to McCarty Wireless Telephone Company, San Francisco, Cal. A plurality of primary coils is employed, one connected to the interrupter and the other containing a variable resistance.

867,896. WIRELESS TRANSMISSION OF SONOROUS VIBRATIONS. Henry A. McCarty, San Francisco, Cal., administrator of Francis Joseph McCarty, deceased, assignor to McCarty Wireless Telephone Company, San Francisco, Cal. Impulses created by sonorous vibrations are caused to act independently.

867,898. SPACE ELECTROMECHANICAL SYNCHRONIZING MEANS. Austin H. Stewart, Nashville, Tenn. A synchronizing clock controlled by electric waves.

867,899. AUTOMATIC STOPPING DEVICE FOR INTERNAL-COMBUSTION ENGINES. Daniel B. Adams, Summitville, N. Y. The automatic stopping device is controlled by the flow of cooling water.



867,900.—TELEGRAPH TRANSMITTER.

867,900. TELEGRAPH TRANSMITTER. John C. Barclay, New York, N. Y., assignor to Western Union Telegraph Company, New York, N. Y. A keyboard telegraph transmitter.

867,901. INSULATOR. John C. Barclay, New York, N. Y. A vitreous insulator with a spiral groove.

867,914. ELECTRIC FAN. Frederick Diehl and Adolph F. Becker, Elizabeth, N. J. A pivotally supported motor.

867,918. ELECTRICALLY OPERATED RAILWAY SWITCH. Frank J. Johns, Scranton, Pa., assignor of one-third to John Nelson Garrett, Scranton, Pa., and one-third to James P. Pulsifer, Philadelphia, Pa. An automatic railway switch.